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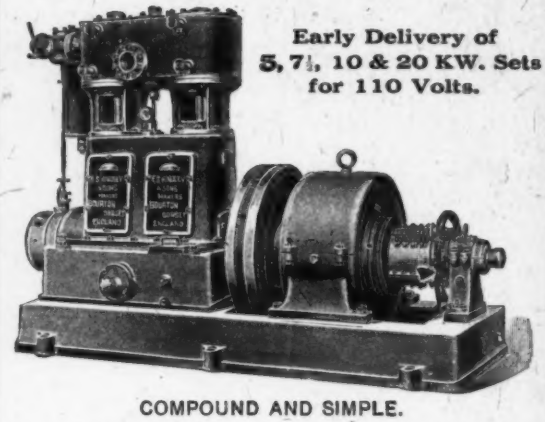

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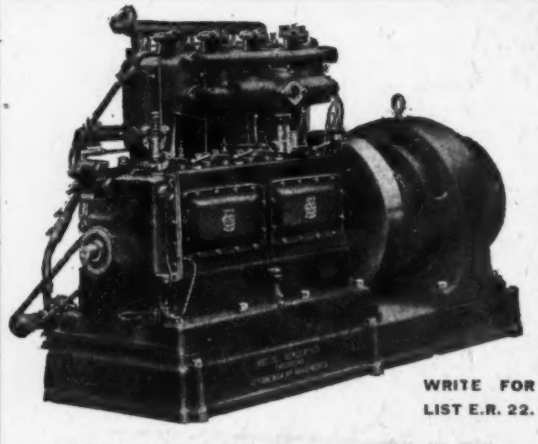

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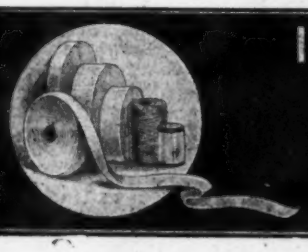

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ELECTRICAL REVIEW.

VOL. XC. MARCH 31, 1922. No. 2,314.

ELECTRICAL REVIEW.

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THE PROGRESS OF THE ENGINEERING LOCK-OUT.

THE situation is subject to rapid kaleidoscopic changes. Over-night the prospects of settlement are reported bright; next morning we read of a "hitch" and a likelihood of the trouble extending. At the moment of writing this article the outlook appeared to have improved. Now, as we go to press, it has changed for the worse, and there seems to be an actual deadlock.

The latest information shows that the conferences have completely failed, as the A.E.U. insisted upon the withdrawal of the lock-out notices when negotiations on the question of workshop practice and managerial control were resumed. The next step was to be the posting on Wednesday of additional lock-out notices affecting men in the other unions. It is stated that this concerns 500,000 workers, in addition to the 250,000 A.E.U. members previously locked out.

The 47 unions who were engaged last week in a ballot on the employers' management memorandum voted, as was to be expected, against the acceptance of the views expressed therein. When a dispute has already been entered upon, and the spirit of combat is in the very air, it is in the highest degree unlikely that the rank and file will be found to be inclined to take long views. Had the engineers been allowed to remain at work, and had the A.E.U. agreed to refer the question again to the membership, there might have been some hope that a stoppage would be avoided.

The Government, fearing that if the House of Commons discussed the situation, provocative things might be said, at first refused to give time for a debate; but wiser counsels appear to have prevailed, causing their fears to be regarded as groundless. A debate therefore took place, and although at one time it seems to have become so lethargic as to have been in imminent danger of dying of inanition, the views of labour, of the Government, and of the employers were enunciated. Stripped of mere debating points, such as the "chipping" of the employers for quoting *Justice* and some of Lenin's conclusions, and the surprising suggestion that a manifesto issued to 30,000 members of the union was "a strictly private and confidential document," we think the fact emerges that both sides have the interests of the country at heart. Although Mr. Gould, of Cardiff, is of the opinion that "we have got to get rid of all this senseless talk about investigation," there was enough of the real truth about the present state of trade in his speech to show that full investigation and full knowledge of all the facts would be of the greatest possible value. Everybody wants to get away from these disputes, which by their recurrence interfere with the national and individual advancement. The best—the only—method of avoiding them is the spread of knowledge of all the factors and conditions involved. Men like Mr. Gould seem to say: "No investigation is necessary. I know the facts, and you must accept my conclusions." The representatives of labour reply: "We also know the facts, but the conclusions we draw are very different from yours." But the final arbiter in these matters is public opinion, and public opinion will insist that the whole truth shall be disclosed, so that a proper judgment may be formed upon the question. Was not a Select Committee of the House of Commons told thirty years ago by a prominent railway magnate of the time that "you might as well have a trade union or an 'amalgamated society' in the army, where discipline has to be kept at a very high standard, as have it on the rail-

ways"? The Committee reported that the working conditions comprehended under the name of discipline were "indistinguishable from white slavery." Would any railway director or high official of to-day speak in that way of trade unions, or consider white slavery to be the only, or the best, method of administration on the railways? In spite of the Englishman's privilege of grumbling, there is no doubt that railway travelling has improved in comfort and in service beyond anything that was thought of in the early nineties, although the N.U.R. has the power temporarily to paralyse industry. Every accommodation between parties to any discussion involves something of giving and something of taking on both sides. There is always a haunting feeling that perhaps too much has been given, that the gain will not be worth the price paid, or might have been obtained at a less heavy price. Complete knowledge tends to eliminate this feeling.

We therefore feel that the Minister of Labour is wrong in not making arrangements at once for the setting up of an Industrial Court. Sir Allan Smith asks what an Industrial Court can do that a conference of eighty men, forty from either side, cannot do. We think the plain man will be inclined to say that it can do a great deal more, can do it better, and can do it more quickly. The Government's view, as expressed by Mr. Chamberlain, is that the setting up of such a court, and the proceedings before it, would cause delay and extend the area of the dispute. All the more reason, then, for setting it up without any delay of a preliminary nature. The area of the dispute has already extended. Is either party afraid to lay its cards on the table? We do not think so. Then there can be no objection from that point of view. It may be that at an Industrial Court Sir Allan Smith would not be able to say: "*We are going* to know where we are. *We are going* to manage the shops, or the shops are not *going* to run. We are going to make this an absolute condition of employment for all trades."

Going, going . . . if there is much more of this sort of talk we shall find that the engineering industry has gone—gone to Germany, or some other country where employers, instead of locking their gates, find work to keep them open. We have pointed out before now that the capable leadership of men is as important to industry as anything can be, and there is much in the view of Mr. Austin Hopkinson that if an employer is not immediately and cheerfully obeyed by his workpeople he should look within himself to ascertain the cause. Nowadays, of course, there is all too little of individuality on both sides, and it must not be forgotten that entrance into a combination for the purpose of collective action necessitates the surrender of the right of separate action. From being able to give effect immediately to the course of action which may appear to be correct, the worker or the employing firm becomes only one of a number, able, it is true, to give expression to opinions and thereby to influence, so far as may be, the views of fellow-members, but not to put those opinions into practice unless and until the majority have been brought into agreement with them. Mr. Hopkinson holds that an employer, by becoming a member of the Federation, abrogates managerial functions and leaves them to the Federation. This, of course, is going too far. Such an employer still has the right, and the duty, of running his own factory, but he does it in line with the general policy agreed upon by himself in common with the other federated employers. The worst feature, in our view, of combinations of this kind, whether of employers or of employed, is that they protect the inefficient. The fastest speed of the body is the fastest speed of the slowest member of it, and the improvement of the worst to be equal to the best is, at best, a slow process, even supposing it to be seriously undertaken or contemplated.

The appeal of the churches will be read with approval by all who value plain and honourable dealing. As Sir Allan Smith admitted when he put his signature to the Whitley Report, and as he stated in the House of Commons, there must be conference and co-operative action between employers and employed. So important, so vital is this, that there must be permanent machinery for the purpose. We said at first that it is evident that both sides have the interests of the nation at heart. Then let us have an end of asperity and impatience, and let both parties try to understand one another. Is the overtime question the governing factor in the dispute? Only so far as it brings into prominence the function of management. Does, or can, any sane employer want overtime as a regular thing, when it costs him half as much again as ordinary time and must necessarily be less efficient? Obviously not. With the dice so heavily loaded against him, the employer will, as we have long ago shown, and as Mr. Hopkinson pointed out in his speech, have every inducement to avoid it, even to the extent of employing more workers or of running more than one shift.

The statement issued by the A.E.U. on "Why We Are Locked Out" does not take the matter very much further. Much is made of the refusal of the employers to accept the qualified recognition of their managerial rights which is conveyed in the clause:—

> The right of the employers to exercise managerial functions in their establishments shall continue as hitherto, and the Union shall have the right to continue to perform its proper functions.

"*That is to say,*" goes on the statement, in italics, "*the Union asked for no change in the existing position. It was the employers who were seeking to alter the relationship previously existing between the parties.*"

It must be remembered that the Union's own interpretation of this was that only those relations established since 1914 were to continue to exist. Now compare the clause with the original, rejected by three per cent. of the membership out of a total poll of twenty per cent.:—

> The Trade Union shall not interfere with the right of the employers to exercise managerial functions in their establishments, and the Federation shall not interfere with the proper functions of the Trade Union.

If the new clause means no more than the old, why was any change made? The existing position had become intolerable, and the Union executive admitted it by offering the terms for ballot.

We believe, as we said at the beginning of the dispute, that it was wrong to accept the decision of so small a proportion of the membership, and the revelations of the slipshod manner in which the ballot was conducted confirm that view. If Mr. Robert Young is right in calling twenty per cent. a very large proportion of the membership, and in saying that the A.E.U. method of conducting a ballot outshines that of the other unions, we can only say it is time that state of things was changed. If the unions are wise, they will see to it themselves; if they do not, it cannot fail to become a question for legislation.

A Market in Jeopardy.

More than twelve months have passed since British trade with Spain was threatened with virtual extinction by the imposition of a highly-protective import tariff. This was described as provisional and was followed by the announcement that permanent legislation was being drafted. But it soon became generally understood that the new tariff was to be more highly protective than the temporary one. Meanwhile the dislocation of Spain's foreign commerce grew increasingly serious, and all those interested in it from the point of view of either export or import trade united in protest against the contemplated legislation. Practically the only section which supported the proposals was the Catalan textile industry. To this section in particular is believed to be due the rigorous nature of the new tariff law, which has now been published and found to justify the worst fears of the various interests affected. Many branches of Spanish industry dependent upon imported supplies of raw or semi-manufactured products, chemicals, and other essential materials find their activities jeopardised by high costs. The fruit growers fear

that retaliatory measures such as have already been adopted in France will deprive them of all their foreign outlets in turn. Every section of the community complains of the excessive rise in the cost of living. Yet the Spanish Government refuses to moderate the levies. It appears to have been blinded to its true economic interests by the pressing need for revenue.

British engineering and other firms engaged in exporting to Spain foresee a profitless end to the agreeable business relationships which they have spent many years in forming and cementing. They have lodged their protests through the Commercial Diplomatic Service, the Federation of British Industries, and the British Chamber of Commerce in Barcelona. On the effectiveness of the presentation of their case depends the ruin or the survival of British trade in Spain. The Commercial Secretary, whose report is summarised on another page, practically acknowledges the truth of this statement. We therefore urge the British Government to use every economic weapon it possesses in order to save the situation.

Private Enterprise in Electricity Supply.

The controversy in connection with the present Electricity Supply Bill has brought up the old question how far the rights of private enterprise will be conserved under the new organisation.

Critics who are whole-hoggers have raised an alarmist cry, but is this borne out by fact? We have now had considerable experience of the Electricity (Supply) Act, 1919, of which the new Bill is the financial supplement. No one can claim that, in carrying out their executive duties under this Bill, any preference has been given by the Electricity Commissioners to municipal trading as such. Whatever decisions have been come to, it is quite evident that the ruling factors have been entirely technical, and in no sense political. By this we mean that the Commissioners have, so far as anyone can see, paid no attention whatever to the question whether any particular project was to be worked by a municipal undertaking or by a company. Certainly it would be difficult to show any anti-company bias. As regards the authorising of company operation we have, for instance, the North Wales Electric Power Co., which has been authorised to erect a hydro-electric station in North Wales. The Yorkshire Power Co. has had a similar permission for a station in its area. On the other side, of course, there are consents such as Nottingham, where the working is under municipal control, but certainly a very even balance has been kept so far. So much for what is public. As to a great deal of work, of which the results do not become public, from all we have heard every possible assistance has been given under the new *régime* to undertakers who have needed it, wholly irrespective of whether they were company or municipal. Broadly, therefore, we think that there is every justification from experience to anticipate that under the future operation of these Acts there will be a full and free field given to private enterprise.

Ignorance, but not Bliss.

The President of the Manchester Chamber of Commerce, in his able speech at the annual dinner of the Manchester Local Centre of the Institution of Electrical Engineers, was careful to make it plain that he did not claim to have any knowledge of matters electrical. Such ignorance of matters lying outside one's own province is not culpable, and it is not expected of the lay Press that expert scientific commentary shall be forthcoming in the ordinary way. We must, however, express amazement at the credulity that has been displayed on several recent occasions. "Synthetic gold" (whatever that may mean) has been discovered by "a German scientist." The particular German concerned turns out to have no scientific knowledge of any value, while it is obvious that gold, being an elementary substance, cannot be "synthesised" at all. "Synthetic coal" is the reputed discovery of another genius, who makes his fuel out of rock and stones. We had thought that this was the long-established practice of the British coal merchant, at all events where domestic coal is concerned.

A fair example of the appalling nonsense served up to (and, apparently, greedily absorbed by) the public, in the name of scientific information, was provided by *The Daily Express* recently in a sensational note headed: "Metal Turned into Gas. Age-Long Dream of Alchemists Solved. Terrific Heat." The substance of it is that Messrs. G. L. Wendt and C. E. Iron, at Chicago University, have transmuted tungsten into helium; and no doubt the proceedings of the Middle West section of the American Chemical Society, before which body this accomplishment was reported, will be found to contain accurate information as to what has really been done. We hope and believe that we are justified in refusing to credit that responsible scientists talked about producing "the highest temperature ever known in the universe," or the discharge of "100,000 volts of electricity at high speed" through a fine tungsten wire, which promptly "exploded with a deafening report, producing a flash two hundred times brighter than sunlight and lasting less than 100,000th part of a second." Under this condition, it is stated, the tungsten wire decomposed into helium gas.

The possibility of transmutation, or the change of one element into another, is not denied, and has been confirmed by experimental evidence obtained from radium and its derivatives. In the case cited, the gas which was principally in evidence was not helium, but something to which we are more accustomed. It is familiarly known as "hot air," and when condensed, it produces sensational paragraphs such as the one before us.

The By-laws of the I.E.E.

The by-laws of the Chartered Institution of Electrical Engineers, which take the place of the Articles of Association of the old Institution, were unanimously approved at the special general meeting last week. The fact is significant of the greater confidence reposed in the Council by the members nowadays, a very satisfactory condition; that confidence is due, we believe, largely to the circumstance that the policy of the Council is framed on broad and enterprising lines, in accordance with the wishes of the membership, and not upon a slavish adherence to precedent and to obsolete traditions which restricted the scope of the Institution's activities. Thus it has come about that the President, at the annual dinner of the North-Western Local Centre last Friday, was able to say that the Institution for many years now had been trying to keep in touch with the commerce of the country, as well as with science, for without trade the work of engineering and of all science would be as nothing. That sentiment appeared in our pages many times during the struggle of ten years ago to save the Institution from the old-fogeyism which threatened it.

Many of our readers, too, will recall the battles of 1911-12 over the mode of election of the Council, which resulted, *inter alia*, in the rule that the number of Council nominees should exceed the number of vacancies, in order to ensure that a ballot would always be necessary; that rule has now been abrogated, without a fight, but the privilege of nominating Associate Members has very properly been extended to the Associate Members, who number nearly three-quarters of the corporate membership. A ballot is still desirable; without it, the constitution of the Council will as formerly be determined wholly by the Council, the members will feel that they have no hand in it, and discontent will again arise. We have been told that the Council welcomes outside nominations, and it will be "up to" the members generally to see that they are forthcoming.

We are glad to see that the strictly technical character of the qualifications for full Membership has been emphasised by omitting the provision which enabled the Council to admit non-technical men to that class.

D

THE GRAPHIC SOLUTION OF A.C. LOAD PROBLEMS.

By J. A. VAN TILBURG.

The following graphic method of solving the various problems arising in daily a.c. practice will no doubt appeal to most engineers.

The method used is both simple and accurate, and can be used for all problems. The entire absence of calculations will prove an advantage to many who have become a little rusty on mathematics.

Example 1 has been set out in detail for the benefit of those not conversant with the graphic method. Examples 5 and 6, applied to synchronous motors, will, it is hoped, prove to be of special interest to many.

Example 1.—Addition of Two Inductive Loads.

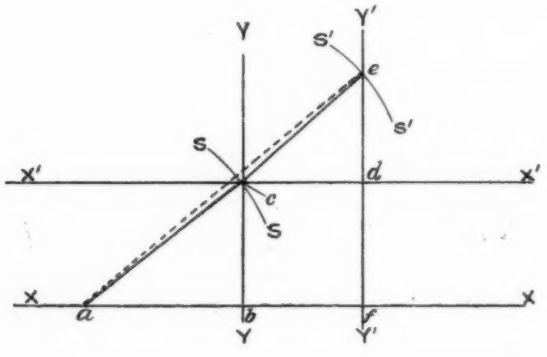
Problem.—To an inductive load 1, of, say, 100 kVA (lagging) power factor 0.8, it is intended to add an inductive load 2 of, say, 80 kVA (lagging) P.F. 0.75.

Question.—What is the resulting kVA load, and what is its P.F.?

Data: *Load* 1 kVA = 100 P.F. 0.8
kW = kVA × P.F. = 100 × 0.8 = 80
Load 2 kVA = 80 P.F. 0.75
kW = kVA × P.F. = 80 × .75 = 60

Construction.—Scale 50 kVA = 1″.

Load 1.—On horizontal line XX set off the distance $ab = 1.6'' = 80$ kW. Draw the perpendicular YY at *b*.



With centre *a* and radius 2″ = 100 kVA draw the sector SS. Draw the line *ac* connecting *a* with intersection of sector and YY.

The triangle *abc* is the vector triangle of load 1 to scale 50 kVA = 1″.

ab = kW load 1, *ac* = kVA load 1 — *bc* = wattless kW lagging.

$ab/ac = \cos\phi$ = P.F. of load I = 0.8.

Load 2.—From *c* draw the line X′X′ parallel to XX.

Set off the distance *cd* = 1.2 = 60 kW.

Draw the perpendicular Y′Y′ at *d*. With centre *c* and radius 1.6=80 kVA, draw the sector S′S′. Draw the line *ce* connecting *c* with intersection of vector *s′s′* and Y′Y′. The triangle *cde* is the vector triangle of load 2. Connect *a* and *e*.

Solution.—The triangle *afe* is the vector triangle of the total load. *ae* = vector sum *ac* and *ce* = kVA total load. *af* = kW total load *af/ae* = P.F. total load.

Example 2.—Addition of Non-Inductive to Inductive Load.

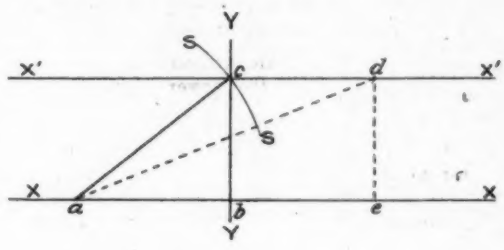
Problem.—To an inductive load 1 (with lagging P.F.) is added a non-inductive load (at unity P.F.).

Question.—What is the resulting kVA load and what is its P.F.?

Construction.—Draw the vector triangle of the inductive load 1 as before to any suitable scale.

From *c* draw the line X′X′ and set off the distance *cd* = non-inductive load 2 to scale. Connect *a* and *d*.

Solution.—The triangle *aed* is the vector triangle of the total load.



ad = vector sum *ac* and *cd* = kVA total load.
ae = kW total *ed/ad* = p.f. total load.

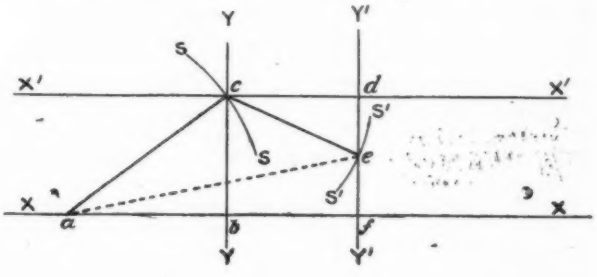
Example 3.—Addition of Inductive Load (Lagging P.F.) to Load with Leading P.F.

Problem.—To an inductive load 1 (lagging P.F.) is added a load 2 with leading P.F.

Question.—What is the resulting kVA and what is its P.F.?

Construction.—Draw the vector triangle of the inductive load 1 as before to any suitable scale.

From *c* draw the line X′X′ and set off the distance *cd* = kW load 2 = kVA × P.F.



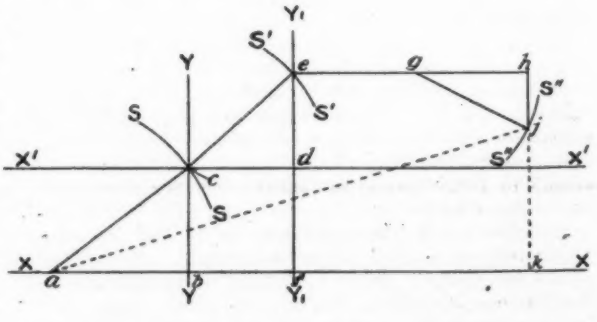
With centre *c* and radius = kVA load 2 describe the section S′S′. Draw the line *ce* from *c* to intersection S′S′ and Y′Y′. The triangle *cde* will be the vector triangle of load 2. Connect *a* and *e*.

Solution.—The triangle *afe* is the vector triangle of the total load.

ae = vector sum *ac* and *ce*, = kVA total load.
af = kW total load. *af/ae* = P.F. total load.

Example 4.—Combination of Examples 1, 2, and 3.

Problem.—To an inductive load 1 (lagging P.F.) is added a load 2 (lagging P.F.) and load 3 (unity P.F.) and a load 4 (leading P.F.).



Question.—What is the resulting kVA load, and what is its P.F.?

Construction.—Draw the vector triangle of load 1 and load 2 as in *Example* 1. From *e* draw the horizontal

line *eg* = load 3. From *g* construct the vector triangle of load 4 as in example 3 = *ghj*.

Solution.—The triangle *akj* is the vector triangle of the total load.

aj = the vector sum *ac*, *ce*, *eg*, and *gj*, = kVA total load.

ak = kW total load. *ak*/*aj* = P.F. total load.

The Application of the Graphic Method to Synchronous Motors.

With the aid of the graphic method it is easy to determine the improvement of the power factor of an inductive load which will result from the addition of a synchronous motor to the load.

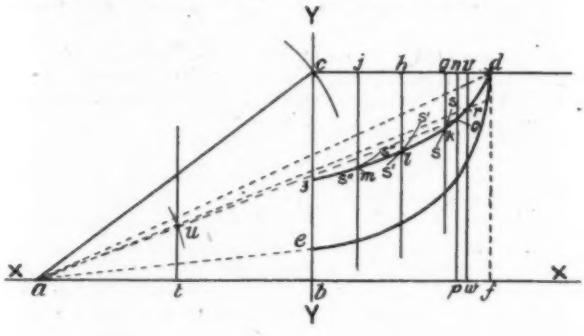
Problem.—To an inductive load, one of say 100 kVA at p.f. 0.8 (lagging), it is intended to add a synchronous motor of, say, 50 kVA.

Question.—What will be the total load and what the improvement in p.f. of the load with various useful loads on the synchronous motor?

Construction.—To scale 20 kVA = 1".

Draw the vector triangle of load 1 as before. With centre *c* and radius 2.5" = 50 kVA (rating of motor), draw the quadrant *de*.

The line *cd* represents the condition where the synchronous motor is doing work to its full rated capacity, *i.e.*, 50 kVA at unity p.f., and the corresponding triangle *afd* is the vector triangle of the total load.



The line *ce* represents a separately driven synchronous condenser of 50 kVA rating and the triangle *aeb* is the corresponding vector triangle of the total load.

It is, of course, impossible to realise the ideal condition represented by the quadrant, and this in practice would be modified to the curve as shown, which can be constructed from data supplied by the makers of the motor as follows:—

Rating motor 50 kVA at p.f. unity p.f. at ¾ load 0.9.
p.f. at ½ load 0.75
p.f. at ¼ load 0.4
all leading.

Set off along *cd* the points *j*, *h*, *g*, representing ¼, ½, and ¾ load. Drop the perpendiculars *gk*, *hl*, and *jm*. We have

P.F. ¾ load = 0.9. ¾ load = 37.5 kVA = 37.5/0.9 = 41.6 approx.

P.F. ½ load = 0.76. ½ load = 25 kVA = 25/0.75 = 33.3 approx.

P.F. ¼ load = .4. ¼ load = 12.5 kVA = 12.5/0.4 = 30.1 approx.

With centre *c* and radius = 41.6 to scale, draw the sector *ss* intersecting the perpendicular *g* at *k*. Do the same at *h* with centre *c* and radius 33.3 to scale; similarly at *j*. We then have the points *d*, *k*, *l*, and *m*, and the curve can be drawn through these.

Example 6.

It is intended to carry 35 kW useful load on the synchronous motor. What will be the total load and what the p.f. of the total load?

Construction.—Along *cd* set off to scale *cn* = 35 kW; drop the perpendicular *np*. Connect *a* with *o* (the point of intersection between perpendicular and curve).

Solution.—The triangle *apo* will be the vector triangle of the total load. As before *ao* = total kVA and *ap*/*ao* = p.f. total load.

Example 7.

It is intended to add a 50-kVA synchronous motor to a load 1, of, say, 100 kVA at p.f. 0.8. The p.f. is to be improved to 0.9. What load can the motor take and improve the power factor as required?

Construction.—Along *af* set off *at* = 2", then p.f. must be 0.9. 2/0.9 = 2.22 approximately.

At *t* draw the perpendicular *tu*; with centre *a* and radius 2.22, draw the sector as shown. From *a* draw the line *ar* through *u* (point of intersection of sector and perpendicular). The line *aur* intersects the curve for the motor at *r*. Draw the perpendicular *wv* through *r*; *cv* will be the useful load in kW on the motor and the triangle *arw* represents the total load.

Remarks:—

1. It will be seen that in this case the improvement of the p.f. of the total load is chiefly due to the addition of load at unity p.f.

2. The radial differences between curve and sector are proportional to the power taken from the line by the motor to give leading wattless current.

3. It will be seen that it is generally not efficient to improve the p.f. of an inductive load beyond, say, 0.95, as a large increase in the capacity of the motor is necessary with only a small increase in wattless leading power, as indicated by the almost horizontal portion of the curve *mz*.

4. It will be apparent that in most cases a more efficient condition will result if the synchronous motor is at least partly loaded. The most efficient point is easily determined by the above method for any particular motor.

NOTES ON QUICK-MAKE, QUICK-BREAK SWITCHGEAR.

By J. ANDERSON.

"Quick-break" has become almost universal on switchgear of all sizes, and is sometimes found in conjunction with "quick-make," but few engineers have paused, in recent years, to consider whether either or both are necessary.

It can be shown that in certain cases quick-break is distinctly detrimental, as, for example, when breaking a highly-inductive d.c. circuit; the quicker the break the higher the induced voltage rise, and the greater the chance of damage to apparatus connected adjacent to the source of the pressure rise.

It can also be shown that in certain cases quick-make is detrimental, as, for example, when switching-on a transformer to a supply system having considerable capacity in the high-pressure supply cables. Apart from any question of voltage rise, there is a considerable instantaneous current rush when switching-on a large transformer, and trouble so frequently results from the tripping of the overload breaker on the feeder that some supply authorities fit slow-make, slow-break oil-immersed switches on the transformer panels, which merely serve as isolating switches, and give a tacit, if not explicit, instruction to the attendant that, when switching-on, he is expected to close the switch slowly till the contacts just touch and "sizzle," thus charging up the transformer and reducing the current rush.

There is a wide field between these limits, where either quick-make or quick-break, or both, may be beneficial,

and a few cases where both are essential, and to crystallise ideas it is convenient to take a few definite cases and examine them in detail.

It is the practice in large supply stations generating alternating current at high voltages to use both quick-make and quick-break oil-immersed switches: quick-make because it is inherent to the electrical operation of the switchgear, and quick-break because it is considered advantageous. In fact, every effort is made to get as quick a break as possible, and initial speeds of break of 11 ft. to 14 ft. per second are aimed at. Some makers go further, and try to expedite the break by means of magnetic blow-out.

If tests in air are any criterion, it may be stated definitely and positively that quick-break in conjunction with magnetic blow-out is necessary only to a limited extent, and through a comparatively very small distance; the speed of break is proportional to the current and the field, and is independent of voltage, and once the constant is known for a given shape of contact it is readily calculated.

It is certain that without magnetic blow-out only very short and slow breaks are necessary for alternating currents at voltages up to 440; a recent test on single-phase 440 volts, 600 amperes, 25 cycles, gave 1/16 in. slow break under oil, and a separation of 0.014 in. in air slow break between copper electrodes is sufficient to interrupt 121 amperes at 440 volts, 25 cycles.

In fact, it is quite a moot point whether quick-break is not a distinct disadvantage with alternating current; if the time of break is shorter than one quarter cycle it is possible to draw out quite long arcs in air. A test with a switch completing its travel in 0.01 second on 25-cycle supply gave 1½ in. for 100 amperes at 440 volts.

The facts are somewhat different on d.c. circuits. The slow-break separation of the contacts is roughly proportional to the current up to about 10 amperes at 440 volts, but above 10 amperes the separation required is erratic, and the only thing that can be said is that it need not exceed 4 in. to 4½ in. for any current at 440 volts.

The actual length of the arc is quite another story, but it is readily calculated from laws deduced from tests made in uniform magnetic fields and assuming that the arc is working in a field equal to the earth's field.

Tests on quick-break show that for speeds of 4 ft. to 40 ft. per second the separation distance of the contacts is the same as for slow-break. In other words, quick-break does no good at all so far as breaking the circuit is concerned; it only decreases the damage to the contacts by reducing the time the arc lasts.

Tests in air with uniform magnetic fields from 0.05 to 10.0 kilolines per square inch show that if regular results are to be obtained it is necessary to separate the contacts at a speed proportional to the current and the field through a relatively small distance, a matter of half an inch or so for currents up to 2,000 amperes, and that neither increase of speed nor increase of separation is of any advantage.

There are certain circumstances where the use of quick-break is imperative, and that is where any hesitation in operating the switch is likely to occur, and they really entail regular uninterrupted break rather than quick-break. An example is a series limit switch on a crane, where the crane may just creep up to the point of opening the limit switch sufficiently to cause arcing, but not sufficiently to break the circuit.

The argument for quick-make holds equally well in this case, because the crane may have travelled far enough partially to close the shunt limit switch and cause destructive sparking before the circuit-breaker opens. Consequently the same general rule holds for quick-make as for quick-break, that where any hesitation in operating the switch is likely to occur either or both are advantageous, and they become more and more advantageous as the currents become greater relatively to the size of the switch.

For example, very few tumbler switches of 5-amp. and 10-amp. capacity on the market to-day will break their rated carrying capacity on 220 volts d.c. If they are operated smartly once they may just clear; if they are operated half a dozen times in rapid succession so that the contact gets hot, they will fail.

If they have cleared the first time or two the contacts have roughened, and the quick-make, quick-break pattern, which should be the best, becomes the worst, because the spring is never of sufficient strength to pull off a badly-roughened knife contact.

From this it follows that, if a quick-make, quick-break tumbler switch is to be really effective and dependable, the knife form of contact must be abandoned and the design must be brought into line with the practice on heavier gear by using some form of block or vee contact which cannot fail to separate even when roughened.

A complete statement regarding the requirements of a quick-make, quick-break switch is that, in addition to the block or vee contact, it should have a positive "push on" to start motion in case the mechanism has got stiff from disuse, and a positive "push off" to start motion in case of roughness or partial welding; in effect, the ideal tumbler switch should be designed on the same lines as are recognised to be the best standard practice for limit switches on crane control.

On the other hand, tumbler switches are rarely, if ever, loaded to their rated capacity; a 5-ampere switch is seldom required to carry more than 1.0 to 1.5 amperes at 220 volts, or double these currents at 110 volts, and even on d.c. it can break these currents so easily that it really does not matter if the quick-make and quick-break are purely nominal; certainly on a.c. it absolutely does not matter at all.

The argument in favour of quick-make on account of the large instantaneous-current rush with metal-filament lamps is purely academic, and does not cut any ice in practice. When these lamps were first introduced people thought that it would be necessary to switch them on through a variable resistance, and several of these resistances were put on the market. To-day no one dreams of using a resistance for that purpose. The current rush is so transient that even a very light contact has no time to heat sufficiently to cause roughening.

A discussion on the ideals of tumbler-switch design is rather futile to-day, when it is almost impossible to get people to accept British-made switches as a gift in the face of the cut-throat German competition.

A LIGHTNING ARRESTER FOR SUBMARINE CABLES.*†

By J. RYMER-JONES.

In constructing a lightning arrester the object of prime importance should be to protect the cable—or other instruments—not only from a single lightning discharge, but from a succession of shocks; and in order to do this satisfactorily the arrester should be provided with the means of self-preservation.

Several methods have been devised for protecting the cable, but only a few include means for safeguarding the efficiency of the lightning arrester itself.

The value of a submarine cable is so great that adequate means must be adopted for fully protecting it—and also the apparatus for working the cable—from injury by lightning. Therefore, in the arrester recommended by the writer, and illustrated by the figure, advantage is taken of a combination, in one instrument, of some of the most reliable methods.

1. Chief importance is attached to the remarkably effectual power of discharging lightning possessed by points ‡, of which there are 48, viz., 24 stout serrated

* No. A 1,056, earlier form; † No. A 1,340, improved form; both made by The I.R.G.P. Tel. Works, Silvertown, London, E.

‡ Siemens & Halske's point lightning discharger; Bréguet's saw-teeth lightning discharger.

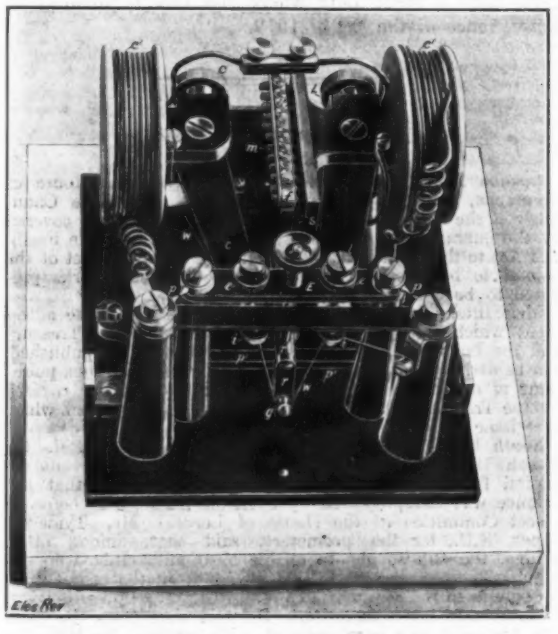
edges, *s*; 12 medium-size screws tipped with platinum, *m*; 10 fine platinum wire points, *f*; and also two pairs of points, *p*, acting as additional leaks for silently discharging the lightning to earth.

2. A plate protector §, viz., two stout metal plates, or, better still, carbon plates, p^1, separated by mica sheet, with air gaps to facilitate discharge to earth.

3. Two choke coils, c^1, to slow and thereby increase the lightning discharge ‖ through the points.

4. A fine platinum wire, *w*, doubly covered with silk, is introduced in the lightning's path ¶, to be fused, and thereby prevent an unusually heavy lightning discharge —part of which might possibly get past the *points* and *plate* arresters—from entering the cable.

This fine wire passes through an ivory eye-hole, *i*, near the end of each of the two flat brass springs, *c* and *l* (connected to the cable and (say) the underground line terminals C and L respectively), for the purpose of drawing them down from their earth contacts, *e*; and, midway between them, this wire dips under the grooved end, *g*, of a light metal rod, *r*, adjustable vertically by the screw *s*, so as to strain the wire near the middle of its length to any desired degree of tension short of breaking. The rupture of this wire and the consequent protection to the cable is further increased by connecting the metal straining rod *r* to earth, so that any part of the lightning discharge that might possibly injure the dielectric, if it entered the cable, is prevented



The Rymer-Jones Lightning Arrester.

from doing so, if it can pass through the silk covering, at *g*, of the wire to earth and thereby localise the heating, and facilitate fusion at this point.

Moreover, another result of the fusion, or fracture, of the wire is to release the brass springs *c* and *l*, and so put both the underground and cable direct to earth automatically—on the principle of the Saunders' lightning guard—until the electric storm has passed and the wire has been renewed. The wire *w* is, however, so efficiently protected by the numerous fine points and also by the plate discharger—in conjunction with the choke coil's slowing power—that, except in very heavy and prolonged electric storms, the fine platinum wire may be expected to remain uninjured, thus rendering spare fusible wires unnecessary.

§ Meissner plate discharger—direct to earth; Fardley (1847) plate discharger—direct to earth; Siemens & Halske's plate discharger—direct to earth. Cf. "The Electric Telegraph—History and Progress." [Robert Sabine.]

‖ Based on the principle adopted by Sir Oliver Lodge.

¶ Bréguet's (1846) fusing fine wire; Fardley (1847) fusing fine wire; Meissner silk insulated wire from the line, twisted around a silk-covered earth wire.—*Ibid.*

It will be noticed that the fine platinum wire *w* is firmly secured at both ends under screws, and therefore it has a constant resistance so long as it remains undamaged by lightning; which fact is an important consideration for preserving a sensitive duplex balance, because any variable contact resistance due to too light a pressure, or dirt, or oxidation, will affect the electrical distribution of charge along the submarine, or artificial, cable to a considerable distance from the sending end.

In this particular lightning arrester reliance is chiefly placed on the very large number of both blunt and exceedingly fine points, not only for safeguarding itself and the cable, but, if necessary, even the metal plates also—if metal is used instead of carbon—from surface fusion during a heavy lightning storm.

Both the points and plate discharges, acting together, are counted on—but especially the former—to protect also the fine platinum wire which provides a constant resistance for duplex signalling; but, so far as lightning is concerned, this wire is only intended to be a last resource for effectually keeping it out of the cable by itself breaking down when the points and plates can no longer serve as a sufficient protection. In other words, it is intended and expected that the fine wire protector will *not* break down, and therefore will not require renewal except under very unusual circumstances.

The above lightning arrester is well insulated, where necessary, on ebonite pillars, and is mounted on a marble slab having holes through which stout and well-insulated leads pass to both the lines and also to the metal earth plate. The instrument is protected by a metal cover, and should, moreover, be installed in a thoroughly damp-proof cupboard.

SOUTH-WEST MIDLANDS ELECTRICITY DISTRICT.

Electricity Commissioners' Decision.

The Electricity Commissioners have considered the evidence given at the inquiry held at Birmingham, in November last, into the scheme for the above-mentioned district, submitted jointly by the Corporation of Birmingham and the Shropshire, Worcestershire and Staffordshire Electric Power Co., and have decided as follows:—

1. The area provisionally determined is confirmed subject to the following amendments:—
   - (*a*) The exclusion of the Municipal Borough of Stourbridge, and the Urban Districts of Rowley Regis and Lye, and Wollescote.
   - (*b*) The inclusion of the remainder of the Rural District of Tamworth, the Municipal Borough of Tamworth, the Parish of Castle Hill in the Rural District of Dudley, and the Parish of Kinver in the Rural District of Seisdon; and
   - (*c*) The inclusion of the Parishes of Bredon, Norton by Bredon, Overbury, Conderton, and Teddington, all in the Rural District of Tewkesbury (Worcester).

     These parishes are within the provisionally determined district as shown on the map issued by the Commissioners, but through inadvertence were not referred to in the Notice of provisional determination.
   - (*d*) The question of the inclusion of part of the Parish of Great Barr, in the Rural District of Walsall, and part of the Parish of Shenstone, in the Rural District of Lichfield, has been reserved by the Commissioners pending the consideration of the evidence given at the local inquiry at Wolverhampton in respect of the North-West Midlands Electricity District.
2. The Commissioners approve generally the joint scheme of the Corporation of Birmingham, and the Shropshire, Worcestershire and Staffordshire Electric Power Co., as amended during the course of the inquiry.

A Draft Order embodying the scheme, with certain minor amendments, will be forwarded in due course to the Corporation and the Power Company, and also to other interested parties, prior to the holding of the further inquiry required by Section 5 (4) of the Electricity (Supply) Act, 1919, which, it is hoped, will take place in May.

COMPENSATION FOR LOSS OF EMPLOYMENT, &c.

By W. S. KENNEDY.

A Note on Section 16 of the Act of 1919.

A question which has recently excited some interest is that of the circumstances under which officers and servants of an authorised undertaker are entitled to compensation under Section 16 of the Act of 1919.

The first case under the Act—that of the Morley electricity undertaking—was dealt with at some length in the issue of the Electrical Review for January 20th, and shortly commented on in the issue of February 3rd.

Into the question of fact in that case it is not the purpose of the present note to inquire; the amounts there allocated seem, on the face of it, to be open to some criticism, but without fuller information than is available to the writer it is impossible to form any valuable conclusion. The section in question is a lengthy one, but may be summarised as follows:—Compensation is to be paid to any officer or servant of an authorised undertaker who (1) has suffered loss of employment or diminution of salary or wages, or (2) has relinquished his employment because he was required to perform duties which were not analogous to those he performed before or were an unreasonable addition thereto, or (3) has been placed in a worse position in respect to conditions of service, including under that head tenure of office and the prospect of such things as pensions, gratuities, sick fund, and other benefits, whether these were legally due or given by customary practice.

The governing words of the section, however, are that the claimant must prove to the satisfaction of the referee appointed by the Ministry of Labour that his change in condition or circumstances arises "in consequence of this Act." Otherwise no claim under Section 16 can be substantiated. Looking into this matter a little more closely, we see that at least one curious consequence follows. The section gives a right to compensation where a certain loss has occurred through one of three causes, viz.: (1) the transfer of an undertaking or part of an undertaking; (2) a scheme for the improvement of supply having come into operation; (3) an agreement for rendering mutual assistance having been entered into between two or more undertakers.

But, as has been said, these causes must have become operative in consequence of the Act of 1919. Now, Section 19 of the Act, which gives authorised undertakers the power to enter into agreements for mutual assistance and other purposes (and under which apparently the agreement between the Morley Corporation and the Leeds Corporation was entered into) merely extends for a specified period to undertakers outside London the powers which were possessed by the undertakers in London, both local authorities and companies, under the London Electric Supply Act, 1908, and the London (Westminster and Kensington) Electric Supply Companies Act, 1908. Certain agreements between London undertakers are already in existence, entered into under the provisions of those two Acts, and to such agreements the provisions as regards compensation in the Act of 1919 do not apply. Nor, it may well be argued, would those provisions apply to further agreements of the same nature entered into by London undertakers. They would be authorised not by the Act of 1919, which is unnecessary in the case of London, but under the earlier powers given by the two Acts of 1908. The question is not free from doubt, for it may be argued on the other side that the Act of 1919 gave an impetus to the making of such agreements, and although they could have been arranged before its passage there would not have been in its absence sufficient motive power to bring them into existence. Reference is here made only to agreements which are made by mutual arrangement between the parties, not to those which are entered into under the compulsory powers of the Commissioners, whatever these may be found to amount to on more detailed inquiry.

It is not suggested that either companies or local authorities in London would willingly treat their officers or employees worse because no legal obligation lies on them to grant the compensation which outside the metropolis must be given. And in the case of the companies it is hoped no difficulties would arise. The local authorities, however, stand in a different position; they are trustees for the ratepayers, and, in the absence of a legal obligation, have little moral right to spend other people's money on schemes of compensation which may not commend themselves to the ratepayers, however generous they may be to those directly interested.

It is believed that a case has arisen where a corporation having purchased a tramway from a company has decided to close down the company's power station and supply the required energy from its own existing station. The question has been raised whether the company's staff who have been discharged are entitled to compensation under Section 16. Since the transaction is one which could undoubtedly have been carried out without any reference to the Act of 1919, the question must be answered in the negative. Other rights to compensation, at common law or under special agreements, may exist, but Section 16, as has been said, gives such a right only where the loss is suffered in consequence of the Act of 1919.

PARLIAMENTARY NOTES.

London Tube Extensions.—On Monday, in the House of Commons, Lieut.-Col. Sir Frederick Hall asked the Chancellor of the Exchequer what was the rate of interest covered by the guarantee of the Government under the Trade Facilities Act to the London Electric Railway Co. in respect of the capital to be raised to carry out the extension works proposed to be executed by the company.

Mr. Hilton Young, in reply, said that details of the agreement which was yet to be completed between the Treasury and the London Electric Railway could not yet be published. The capital needed by the company would be raised by a public issue of debentures, and the rate of interest to be covered by the Treasury's guarantee depended on the terms on which that issue could be made.

South Wales Electrical Power Distribution Co.'s Bill.—On March 24th this Bill, which sought to reduce the ordinary capital from £610,120 to £152,530 on the ground that the balance was unrepresented by available assets, was before a Select Committee of the House of Lords. Mr. Tyldesley Jones, K.C., for the promoters, said that, among other things, the Bill sought to enable local authorities who entered into an agreement to take energy from the company to contribute to the company's capital. The only opposition was from certain gas companies. He said that from the start the company was overburdened with capital. In 1907 the company was in difficulties and large consumers came to the rescue and formed the Treforest Electrical Consumers' Co., which entered into an agreement with the Power Co. and the debenture holders, by which the undertaking was to be carried on by the Consumers' Co. for the benefit of the consumers who agreed to find the money. It was explained that the Bill would be the means of saving a large amount of money to local authorities, who would otherwise have to provide their own supply.

Counsel appeared for eleven gas companies, who took exception to the ratepayers' money being put into an alien concern over which they had no control whatever. The Committee were of the opinion that the Bill should proceed.

Cardiff Corporation Extension Provisional Order Bill.—This Bill has been before Lord Newton's Select Committee. Opposition to certain clauses was offered by the South Wales Electrical Power Co. According to the *South Wales Echo*, the principal point at issue was the dispute between the Corporation and the Power Co.

Counsel said the Corporation, as successors to the Rural Council in the added areas, were prepared to take over the agreements the Council had with the company in respect to electrical supply in bulk. The company were bound to supply, but the Council were not bound to take. They were, however, under obligation to pay £150 per annum to the company whether they took the current to the amount or not.

The Corporation were only taking one-fourth of the area and they offered £40 per annum.

Counsel for the company asked that Cardiff be put under

the obligation to take from the company all electricity supplied in the added area east of the River Taff until the expiry of the agreement 18 years hence.

The Chairman said the Committee were of the opinion £40 was insufficient, and that a reasonable amount should be agreed by the Corporation and company in consultation.

The parties undertook to do so.

Doncaster Corporation Bill.—This Bill, which proposes, amongst other things, to give to the Council further powers with reference to the electricity undertaking and to authorise it to run motor omnibuses as an extension of the tramway service, was under consideration last week by a committee of the House of Lords.

German Electrical Plant.—Mr. Haslam asked the President of the Board of Trade whether he was aware of the difficulty that English companies had experienced for some months in obtaining quotations for electrical plant from German firms; and could he state whether this condition was due to electrical firms in Germany being too heavily engaged owing to the urgent demand for German home purposes and also for the needs of neutral countries?

Mr. Baldwin replied: My attention had not previously been drawn to this particular matter. As regards the second part of the question, I understand that many branches of the electrical industry are actively engaged on home and also, to some extent, on foreign orders.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION (INC.).

A WORLD-POWER CONFERENCE AT WEMBLEY IN 1924.

The report and accounts of the Council of the B.E.A.M.A. for the year ended September 30th, 1921, were submitted at the annual general meeting held at the Connaught Rooms on March 16th. There was a large attendance of members.

Mr. W. O. Smith (Elliott Bros. (London), Ltd.), Chairman of the Council, who presided, presented and reviewed the accounts and balance sheet, and the accounts were unanimously adopted. The chairman then proposed the adoption of the report, and in speaking to the motion said that at the last annual meeting he was compelled to deal with the then existing situation in a somewhat pessimistic tone, and in the light of subsequent events he thought they would agree that the pessimism was justified. The industry at that time was in a bad state, but it was nothing to what they had since had to endure. Soon after last year's meeting came the coal strike, lasting for many weeks, and it was followed by a business depression such as had never been experienced in the life of the electrical and allied industries. He ventured then to assert that the tone of the Stock Exchange was one of the best indications of the state of the trade of this country. He still held that opinion, although experts explained that the recent boom was due solely to the fact that vast sums of money which had accumulated on deposit at the banks had (owing to the reduction of the bank rate, and the consequent small interest allowed on deposits) been withdrawn, and there had been a wild scramble for gilt-edged securities, to obtain a better yield; hence, the abnormal rise in those securities. The increase in values, however, was not confined to gilt-edged securities, for many others, and even industrials, had received a good deal of attention. Mr. Smith continued: "What I look at is that, whereas a year ago the Stock Exchange was in the depths of depression, to-day there is buoyancy and optimism all round, and I venture now to express the conviction that the feeling of optimism in that quarter will gradually permeate other branches of business, and those who have been holding back to see which way the cat jumped will, before long, sell out of the gilt-edged securities and utilise the money so released in financing new enterprises and new developments or additions to existing plants, and a fair proportion should find its way into the electrical and allied industries in the shape of orders. I do not think for a moment that we shall see an immediate boom. The start may be slow, but so long as it is gradual and increasing the improvement is the more likely to be solid and durable."

The speaker said it was far easier to work an Association like the B.E.A.M.A. when everybody was busy and profits were being made, and every member felt that he was doing all in his power, not only for himself, but also for the good of the industry as a whole. It was a different matter when work was scarce and order books were more or less empty. It was then that the individual firm or company was tempted to act for himself and his own pocket, forgetting entirely the good of the industry. What would be the result if that course were generally adopted? There would be a scramble for any work going about; and the industry would find itself in exactly the same unsatisfactory position as it was before the B.E.A.M.A. was started, namely, that the only one who benefited by a cut-throat policy would be the consumer, whilst the supplier would be working either at a loss or at such a small margin of profit as to be unremunerative. Again, what would be the position of individual members? If the B.E.A.M.A. had done nothing else it had done splendid work in bringing them together to know each other and to trust each other. It had taught them that their competitors were human and as honest as themselves, instead of, as formerly, their worst enemies and terribly dishonest people. "Are we to continue in the happier state which the B.E.A.M.A. has brought about or are we to revert to the pre-B.E.A.M.A. state? If the former let us exercise patience, and act as if we knew that, in the apt words of an old philosopher: 'That which is not for the interest of the whole swarm is not for the interest of a single bee.' Better times are surely coming, and when they do we shall reap the benefit of our patience and our bonds of union. In this way we shall emerge from the trying ordeal through which we have been passing stronger and more united than we have ever been before."

The B.E.A.M.A. director brought before the Council last autumn a scheme which he designated "The World-Power Conference," the object of which was to bring together, in London, experts from all parts of the world to discuss the important subject of "power" in its many aspects. The scheme was carefully considered by their Council at several meetings, and, as a result, they authorised the director to promote the conference which, by the kind permission of the Executive Council of the British Empire Exhibition, would be held at Wembley during the spring or early summer of 1924. The Association was inviting technical institutions and trade organisations in this and other countries to co-operate in this enterprise. The exhibition authorities had agreed to give the use of a conference hall at the exhibition free of charge, and to provide certain entertainment for guests from other countries.

Mr. Smith next mentioned a personal matter, which had already been referred to in another place. Three years ago the Council were good enough to elect him as their chairman. He accepted the position with some reluctance, feeling that it should have been filled by a younger man. The confidence which the Council then showed in him was repeated by two further elections to that position. He felt that now, for two reasons, the time had arrived when he should retire. "Those reasons are that I feel it will be for the good of the B.E.A.M.A. and fair to myself: Good for the B.E.A.M.A., because I feel that three years is quite long enough for anyone to hold the chairmanship; one has probably got into a groove and new blood is required. Fair to myself: because after nearly fifty years of business life I am beginning to feel the want of a little more leisure and less responsibility. I can assure you that the office of chairman entails a great deal of work, but I have been fortunate in that my health has stood the strain so well that since I became chairman, three years ago, I have not been absent from a single council meeting. Those three years have been very pleasant years for me, for, whatever work has been entailed it has been a great satisfaction to assist in the fostering of those great principles of co-operation for which the B.E.A.M.A. stands." He was not retiring from the Council, and he hoped, at least, to be able to work out the remainder of his three years' sentence at the Council table. He returned thanks for the kindnes and courtesy that he had invariably received from every member of the Association with whom he had been brought into personal contact, and concluded by tendering his special thanks to the staff of the Association.

[We understand that at a subsequent meeting of the Council Mr. B. Longbottom (Electromotors, Ltd.) was elected chairman of the Association.—Eds.]

Mr. Smith then proposed the adoption of the report, which was seconded by Mr. Pybus, managing director of the English Electric Co., Ltd., and carried unanimously.

The Chairman then declared the result of the ballot, to fill the five vacancies on the Council, and after the re-election of the auditors and a vote of thanks to the Chairman, proposed by Mr. Berry (British Electric Transformer Co., Ltd.) the proceedings terminated.

The report of the Council, from which we shall next week give extracts, shows that the membership at the end of the year numbered 200. A year previously it totalled 224. The report reviews the state of the home and export trade, Parliamentary matters, the conference of the Joint and Industrial Councils, the Electrical Research Association, and deals with standardisation, traffic, conditions of contract, the work of the B.E.D.A., the I.P.S., and relations with other Associations. The Council has under consideration proposals for participating in the British Empire Exhibition, 1924.

THE TELEPHONE SERVICE.

The Report of the Select Committee appointed to inquire into the organisation and administration of the Telephone Service was issued last week (H.M. Stationery Office, Blue Book No. 54, price 4s.).

The Committee comments on the absence in this country of friendly feeling between the telephone service and the public, which is found to exist abroad, and whilst regretting the aloofness of the public, is inclined to blame the Post Office, remarking that the latter "has given some ground for saying that it appears to believe that the public was made for the Post Office and not the Post Office for the public. It tends too much to a cast-iron application of regulations in an improper way."

It considers that the re-organisation of the telephone administration on more commercial lines is the fundamental requirement for efficient development, and recommends the separation of the telegraph and telephone department from the mails, without, however, removing them from the control of the Postmaster-General. The existing organisation is criticised, and contrasted with foreign practice, according to which a Director-General is placed in control of the telegraph and telephone services, with large powers, and is responsible directly to a Minister, whereas in this country these services are controlled by the Secretary's Department, which possesses no special qualifications for the work. A thorough reform is recommended, to be entrusted to a body of men of wide administrative experience not connected with the Civil Service. The terms of reference did not cover the question of restoring the telephone service to private enterprise, but the Committee states that practically all United States authorities claim advantages for that policy; it also points out that in other countries co-partnership schemes with farmers have been very successful, and suggests that more might be done in that direction here. The Post Office has not taken a sufficiently broad view of the development of rural telephony, which is of advantage to other classes of subscribers besides farmers, and a definite policy of development should be formulated. Additional trunk lines should be laid as required, without waiting until materials are cheaper.

Where the Post Office is not disposed to undertake active development the Committee suggests that licences may be granted to local authorities or to co-operative associations, under satisfactory arrangements, and cites the Ontario Telephone Act, 1918, as a suitable basis, the Railway and Canal Commission being indicated as an appropriate body to grant sanctions for such schemes. The conditions to be fulfilled are that the area applying for sanction should furnish evidence showing that: (1) telephone facilities are not available at reasonable rates; (2) a responsible authority is prepared to undertake the work; (3) proper financial guarantees are forthcoming; and (4) definite plans and estimates have been prepared and opportunity given to the Post Office for approval or criticism. New plant might be supplied at cost price through the Post Office at less cost than the responsible authority could purchase it for.

Regarding wages, the Committee finds that in 1920-21, when there was a deficit of £4,480,000, the war bonus paid in the telephone department was £4,700,000, and that the Post Office was paying on an average 64 per cent. in excess of the commercial rates ruling in London. As the cost of living falls wages will go down, approximately at the rate of £190,000 a year for each 5 per cent. reduction, and the Committee insists that telephone charges shall be correspondingly reduced. Exception is also taken to the addition of the war bonus to the 1920 wages, instead of to the rates paid in 1914, as in other trades.

The commercial accounting system is approved, but the Committee points out that the estimates of outlay on which the existing telephone tariff is based are now in excess of the actual cost, and that the provision for depreciation should be adjusted in accordance with the conditions of to-day. Thus, the annual charge for depreciation might be reduced from £2,960,000 (in 1922-23) to £2,484,000. It is also suggested that salaries and other overhead charges for new construction and renewals should be debited to the capital and depreciation accounts, and not to revenue, as at present, the saving to the present user amounting to £586,000 on the figures for 1920-21. The total annual savings to the present user, therefore, would be at least £1,062,000, permitting of a reduction of not less than 8 per cent. in the telephone charges.

The Committee points out that in the Post Office estimates for 1920-21 an item of £2,191,000 appears for "capital expenses for telephone administration," which is used for interest and repayment of loans, and is charged to revenue, whereas in a private undertaking part of it would undoubtedly be charged to capital. To avoid this undue burden on the taxpayer the Post Office should have a capital account. Commercial methods should be followed, and a profit and loss account should be instituted, the balance remaining after paying interest on borrowed capital being carried forward instead of being credited or debited to the Treasury.

In view of the reductions in cost outlined in the report the Committee recommends that a reduction of 10 per cent. be made on subscribers' accounts for service given after March 31st, 1922, without prejudice to other modifications, and that the rate for extra mileage be reduced from £10 to £5 per annum.

The Committee, whilst giving due weight to the evidence expressing doubt whether telephone extension is a paying proposition, suggests that the larger the number of subscribers connected with an exchange the larger will be the probable number of calls made by each, and that while the total cost of serving a subscriber may thus be increased, the total cost per call to the department may be reduced.

Delays in transmission are attributed mainly to an inadequate provision of trunk lines, and the Committee points out that really adequate facilities would create a demand for trunk service. Inexperience on the part of operators is blamed for delays, and also for the wrong-number trouble.

The Committee dissents from the view that the basis of the tariff should be the actual cost, pointing out that a high development in residence telephones is a great factor in accelerating general development, and thus lowering rates; residence telephones, therefore, should be charged for at a lower rate than business telephones, which, moreover, are paid for out of income not subject to income tax. A uniform rate for the whole country is considered unfavourable to development; it is suggested that the country should be divided into areas, in each of which a local advisory committee should be constituted, with a voice in determining the incidence of charging and the grouping of localities. The Committee approves of the message rate as the basis of charging, and condemns the flat rate for business lines, though it may serve for small areas, but thinks that a lower annual rental might be charged for residences than for business premises. The charges for trunk-line service should have been raised sooner than they were, but the scale should be less steeply graduated for the shorter distances.

Sir Evelyn Cecil was the chairman of the Committee, and it is interesting to note that this was the first occasion on which an expert assessor (Mr. W. W. Cook) was appointed to assist such a committee in its deliberations.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Warning.

I should like to draw attention to the increasing practice of certain extreme municipal undertakings. Several instances have lately come to my notice, of men of known and pronounced Communist ideas, being worked into various large power houses. These men start, usually, in a fairly low grade, but are promoted to positions of vital importance as soon as possible. This means that in the event of trouble, either political or industrial, the control of vast amounts of power will be in the hands of these, only too anxious to do harm. In cases where technical knowledge is lacking, by posing as Labour men they are pulled through by the men under their charge. In a power house it is almost impossible to let a man down without letting oneself down as well. In justice, I must say, I have not found either an E.P.E.A. or an E.T.U. man in the above category.

C. B.

March 24th, 1922.

The Lock-out of the Engineers.

One cause of the present trouble appears to be the failure of the attempt to regulate the working of overtime by means of legislation or agreements between the employers and the unions, nor is it easy to see how a practical working arrangement is to be arrived at until both sides recognise that the whole question rests with, and rightly so, the individual employé, and that neither the employer nor the union has any right to dictate to him as to when he should or should not work overtime. The regular working hours constitute part of an agreement between employers and employed, are the same for all and may well be settled on behalf of the men as a whole by their union; but every man, no matter what his particular work may be, has the right to expect that after the usual working hours his time is his own, and that it shall not be regarded as an offence if he decides to cease working at the regular time. Once you concede to the employer the right of dismissal for refusal to work overtime the workman becomes a slave in effect, and it is natural and reasonable for him to resent such a position. On the other hand, the unions should have no more power over the free time of the individual than the employer, nor any right to prevent a man's working overtime if he wishes to. The result of their interference is shown by the present situation, in which the unions are using their powers for political purposes or under the mistaken conviction that the prohibition of overtime will increase employment. Some employers may contend that they must have

the right to demand overtime or they could not carry on. To such the reply is that, apart from trade union influence, men are in general eager enough to work overtime, and for two very good reasons—they are glad of the extra money and also consider it good policy to oblige their foreman or manager, incentives which are sufficient in themselves. If only the employers on the one side and the unions on the other would recognise the fundamental principle that neither should have any right to dictate to, coerce, or interfere with the individual worker with respect to the disposal of his time after the regular working hours in any way whatever, the overtime difficulty would probably disappear.

Some 25 years' experience of the matter from the employer's point of view leads me to the conclusion that it depends entirely upon mutual goodwill, which is not likely to be promoted by the intervention of the unions.

G. Szekacs.

Tatsfield, Surrey.
March 22nd, 1922.

A High-resistance Fault.

To locate a fault in a three-core cable in which the insulation resistance between cores is 50,000 ohms, and between cores and earth 20 megohms, such as described in the current issue of the Electrical Review by your correspondent, "Review Reader," presents no great difficulty if due care be taken in making a test.

A method which has been used in a similar case, and which is based on "fall of potential," is as follows: At one end of the faulty cable make a low-resistance connection between one core and the lead sheath, and isolate the remaining cores. At the other end arrange a few secondary batteries and an ammeter, and send through the loop, formed by the core and the sheath, a current sufficient to give a readable deflection on the instruments to be used. Then, take a reading on a galvanometer connected across the core, to which reference has already been made, and one of the isolated cores, and, in order to overcome any local e.m.f. set up in the fault, repeat this reading with the main current reversed. Now, connect the core at this end to the sheath and, removing the apparatus to the other end, take a similar set of readings while a like current is passing through the loop. Call the mean of the first two readings a, and the second two b. Then, if the length of the cable is L, the distance, x, of the fault from the end where the a readings were made is given by the equation $x = aL/(a + b)$.

To render the matter clearer, diagram 1 is appended.

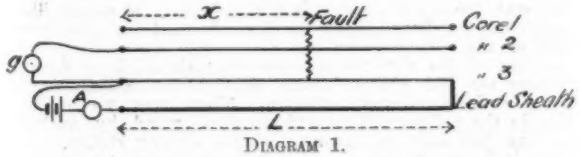


Diagram 1.

Another method, capable of being applied with different apparatus, is a bridge method, and is as under:—

As in the preceding case, join one core, marked 3 in diagram 2, to the sheath at one end B. At the other end, A, connect a length, say 10 ft. of wire—No. 20 S.W.G. tinned copper answers very well—across the core 3 and the sheath; and a portable battery, giving about 100 volts, to one of the

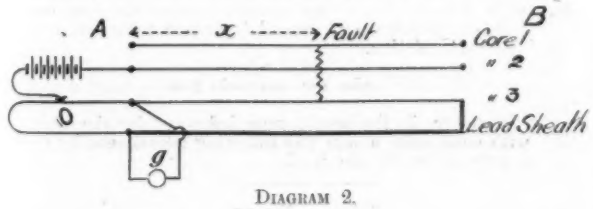


Diagram 2.

isolated cores and to a point, O, on the test wire such that no deflection is observable on the low resistance galvanometer connected across the two ends of the testing wire. Measure the length of wire from O to the core 3, and from O to the sheath: call these lengths a and p respectively. Now, carry out a similar test at the other end, B, of the cable and call the lengths thus obtained b and q. Then the position of the fault is given by:

$$x = L/(C+1)$$

where x = the distance from end A to the fault L = the length of the cable and $C = b(a+p)/a(b+q)$, which expression simplifies to b/a, if the same length of wire has been used when testing at each end.

C. G. Watson.

London, N.17.
March 26th, 1922.

The Lead-Hydrate Storage Battery.

With reference to the above article in the Electrical Review of March 24th, it would be interesting to hear from those who have had experience with this type in actual practice, as compared with the ordinary lead-oxide accumulator.

D. Mitchell.

London.
March 25th, 1922.

The Institution Building.

Immediately following the Faraday celebrations you inserted my letter calling attention to the bad illumination of the lecture hall. Since then the Member of Council who, together with our immediate past-president, was responsible for the alterations, announced at an ordinary meeting of members (commented on in "Electrical Industries," on December 7th, 1921), has informed me that at the Faraday celebrations the top lights were omitted to be turned on, and also shown me the details of the altered illumination, which was fully used at last Thursday's meeting.

It is good to know the Council were not satisfied with the illumination, when we returned "home," but it is to be regretted that the altered lighting cannot be called a real improvement or form an object lesson in good practice.

The cove lighting, above the Council table, has been abolished and the illumination of the side coves tapered, from zero to maximum in the 10 or 15 feet adjoining it. The back cove is fully illuminated. To compensate for the resultant lack of light around the President, four high-candle power half-watt (inert gashlled) lamps have been fixed above the glass ceiling, so that the President is fully aware of "the fierce lights that beats upon a throne," for he suffers from glare both from the opposite cove and especially from the direct rays of the ceiling-lid lamps.

The improvement is a shuffle and not radical.

The illumination in other parts of our home is apparently having attention, for newly erected milk-glass hemispheres of an obsolete and inefficient type are being tried in one room, apparently regardless of the fact that this form of semi-indirect illumination is already dying out.

As destructive criticism should always be supported by constructive suggestions, I am sending to the Council scheme that will be an improvement on what we have at present, in our lecture hall, and the object of this letter is to get others, who have the interests of correct illumination at heart, to do the same so that the whole question can be reconsidered and a model up-to-date illumination be obtained.

Justus Eck, M.I.E.E.

London,
March 25th, 1922.

Safety First.

"The decision which has been arrived at in England to allow the installation of a 1,500-volt third rail is, presumably, for special cases only and for the operating conditions and clearances pertaining to railways in Great Britain and which do not exist in America,"

"It will be difficult to install within American railway clearances a properly insulated and protected 1,500-volt third rail—in fact, it is believed impracticable to do so in a manner which will adequately safeguard the public and the employés."

In my opinion it is equally difficult and impracticable in Great Britain.

Those extracts from Mr. George Gibbs's report in Bulletin I.R.A., December, 1921, on electric railways, to be dealt with by the International Railway Association next month, deserve more prominence in Great Britain than has been given them, particularly with a view to avoiding quite unnecessary risk of railway employés' lives.

No more practically experienced railway man has commented upon the Advisory Committee's decision. As long ago as 1903, when Mr. George Gibbs was commissioned by the directors of four New York (now electrified) railways to suggest the best location for the third rail to meet the requirements of steam and electric railway conditions jointly, he especially dwelt upon providing for "the safety of employés and public," and we should now heed his tactful criticism of Great Britain's decision which does not adequately safeguard employés or public.

Does anyone know of any operating conditions or clearances in Great Britain on railways where 1,500 volts can be installed near the ground in a manner which will adequately safeguard the employés and public?

I do not know of any.

Where, if any, are the "special cases only" in Great Britain, which Mr. George Gibbs presumes the Advisory Committee knew of? Why are they not specifically listed?

By all means make progress, but make it safely; and do not take quite useless risks with the lives of others.

Reasonably Safe.

March 24th, 1922.

Cost of Living in India.

In reference to the inquiry of your correspondent, Mr. T. Jager, on the cost of living in India at Rs. 1,000, it may interest him, and others, to know the difference of thirty years ago. I then lived, and kept up appearances, in the best part of Calcutta (Kyd Street) for nearly two years, on a salary of Rs. 60 per month, increasing to 75 and 100; true it was rather a pinch, but with care I could afford an occasional visit to the theatre, and other little luxuries, and altogether had a jolly good time, and kept my balance on the right side. If I could put the years back, I would jump at the chance of going out there on the same conditions.

Study economy and live like a lord.

J. M. Lee.

London,
March 27th, 1922.

LEGAL.

J. Gliksten & Son, Ltd., *v.* State Assurance Co., Ltd.

The hearing of this action was concluded on March 24th, before Mr. Justice Bailhache and a special jury in the King's Bench Division, after having occupied the court for four days. The plaintiffs, who are timber merchants, of Corporation Road, Stratford, E., claimed £10,000, as the aggregate amount due from the defendants under three insurance policies of £6,000, £1,500 and £2,500, against loss of timber by a fire which occurred in August last.

Sir John Simon, K.C., Mr. B. H. Cohen, K.C., and Mr. Cyril King appeared for the plaintiffs, and defendants were represented by Mr. R. A. Wright, K.C., Mr. Douglas Hogg, K.C., and Mr. Roland Thomas.

The defence was that the loss was occasioned by riot or civil commotion, and that as it was an exceptional risk they were not liable. They said, further, that the policies contained a warranty on the part of the plaintiffs that the timber, &c., insured should not be placed within 100 yards of a saw-mill. They alleged that there was a saw-mill at all times on the premises and that they were liable, if at all, only for timber which was placed more than 100 yards from the mill.

The plaintiffs, in reply to this, said that they gave notice to the defendants when they were about to erect the mill, and the defendants assented to the alteration in the risk. Defendants also said that if they gave a warranty it was not for 100 ft. but yards.

Sir John Simon, in opening, explained the situation of the plaintiffs' yard and the circumstances under which the fire originated, stating that it was for the defendants to prove that it was caused by riot or civil commotion. Plaintiffs were, he said, going on three policies out of a greater number that covered the whole of the plaintiffs' premises, because at the time of the outbreak the whole of the timber was valued at £673,000. Although the insurance companies were informed of the saw-mill they did not elect to go off the risk, and at the time of the fire none of the insurance companies had endorsed on plaintiffs' policies the particular zone which they were covering. The first question was, what caused the fire? and the plaintiffs denied that it was the outcome of a riot. On the previous Friday (August 5th) plaintiffs had advertised for timber porters, and offered 65s. a week as wages, inviting applications at half-past seven o'clock on the Monday morning. Applicants appeared in large numbers, a few hundreds presenting themselves at the entrance to the yard. The gates were pressed open by the crush, but there was no ground for saying that the men were riotous or violent. About 20 or 30 men were picked out and the rest were told that they would not be wanted. That, no doubt, caused a demonstration, and the men did not leave the yard for a time, but within an hour, with the help of the police, the yard was cleared. The shed in which the fire started was stacked with valuable timber, and it was the middle one of three of the same size near the new saw-mills. Each shed, being dark inside, was lighted by electricity, the lamps hanging from the roof. A considerable wind was blowing, and the lamps swung about, and the smashing of one of the lights or the rubbing of the wires was the probable cause of the fire. It was just as the hooter was going for one o'clock that Mr. Gliksten's attention was called to smoke issuing from the middle shed. The roof was alight but not the timber, and as the roof was 30 ft. from the ground the fire could not have been caused by some lurking miscreant. The idea that the fire was caused by incendiarism by the disappointed men might be dismissed from the minds of the jury because the police remained in force for some time after the men had left and saw nothing of any raid upon the premises.

Mr. Reuben Gliksten, chairman and managing director of the plaintiff company, gave evidence in accordance with counsel's statement, and said that the fire raged for four days. There was no truth in the suggestion that the fire was caused by men who raided the yard.

Answering Mr. Wright, K.C., witness agreed that on August 3rd he had made formal application to the police authorities for compensation on the ground that the fire was caused by riot, but that he did on the advice of his solicitors.

Several of the yard employés were called to prove that the fire was not caused by riot, a view in which they were confirmed by police officers.

Mr. James Swinburne, electrical expert, said that when the fire broke out on the tarred roof of a building like plaintiffs' sheds it would create black smoke, such as was seen in this case when the fire started. Witness explained how, in his opinion, the fire occurred from a fault at one of the electric fittings in the roof, caused through the constant swinging of a lamp by the wind.

In cross-examination, witness agreed that if within four minutes there was a great burst of flame it would look as if the fire started from the bottom. There were, he said, weak spots in plaintiffs' electric lighting installation through years of use, and the evidence of witnesses as to what they saw when they rushed into the burning shed was quite consistent with his theory that the fire started in the roof of the building.

Mr. C. V. Hill, civil and electrical engineer, of Old Queen Street, Westminster, gave evidence in confirmation of that given by the previous witness, and said, in cross-examination, that plaintiffs' wiring installation did not infringe the wiring regulations of the Institution of Electrical Engineers. It had been in use for 9 or 10 years. He thought the hanging flexible wires might have become frayed by the constant swinging in the wind, and so have been reduced in section until the few remaining strands were overheated.

For the defence, witnesses were called to support the assertion that the fire was caused by some of the men who had failed to get employment, and one witness had heard it said that Gliksten's yard ought to be burned down, while another asserted that he had heard a man say "you'll see a flare-up soon."

Mr. Wright contended that the fusing of the electric wire was highly improbable, and asked the jury to find that the yard was set on fire by the disappointed men.

Mr. Justice Bailhache, in summing up, spoke of the importance of the issue which the jury had to decide: first, on account of the large sum of money involved; and, secondly, because if the story told by defendants' witnesses were true, the police were deserving of the greatest censure. The destruction of such a property at such a time, and under such circumstances, said his Lordship, almost amounted to a national disaster. It was for the defendants to satisfy the jury that the fire was caused by rioters, and they would have to say whether the yard was set on fire by incendiaries, because that had a great bearing on the case. If, as the plaintiffs had said, the fire originated in the roof, then, of course, the men could not have started the fire. A great deal had been said of the extraordinary coincidence that upon the very morning of the riot the electric wires should have fused, causing the fire, and he agreed that it was extraordinary. His Lordship pointed out that there was no exception in the policy with regard to fire caused by wicked persons, but only fire caused during a riot by rioters. If there had been a riot, then plaintiffs could claim nominally against the police for compensation. The great difficulty in the case was the difference of time between the riot at ten o'clock and the fire at one o'clock, and there certainly was no evidence that the men using sticks and stones against opposition were incited to riot and set fire to the yard.

The jury, after a short consultation, found that the fire was not caused by incendiaries, and that at the time of the fire there was no riot.

After the jury had been discharged counsel proceeded to deal with the legal question involved regarding the conditions of the policies, and several insurance witnesses were called in that relation.

Mr. Wright contended that the insurance was inoperative as soon as plaintiffs broke the warranty not to erect a saw-mill.

His Lordship, in the result, gave judgment for the plaintiffs, with costs upon a sum due following adjustment by the proper persons to do the work.

Wall *v.* Falcke.

In the King's Bench Division on March 22nd, Mr. Justice Branson, sitting without a jury, had before him an action in which Mr. A. E. Wall, of Pinner, sought to recover from Mr. Cecil E. Falcke, secretary of the B.E. Co., Ltd., manufacturing electricians, of London and Birmingham, £250 money received. Plaintiff took over the company's established business of Witchall & Co., who made electric switches, after the war, and wanted a selling organisation. He consequently came to an arrangement with defendant to have the use of his company's selling organisation. Plaintiff said his part of the arrangement was that he should take £250 worth of shares from one of the defendant company's shareholders—a Mr. Bayliss, of Warwick Road, Acock Green, Birmingham. Plaintiff alleged that although he had paid his £250 he had never received his shares, and he asked for a return of his money.

The defence set up was that it was never proposed that plaintiff should have £250 worth of shares, and it was alleged

that his payment of £250 was not for that number of shares, but as an instalment in part payment of £750 worth of shares.

Defendant gave evidence, and said he did not stand to make or lose anything out of the transaction. Mr. Bayliss knew that he was selling the shares to plaintiff.

His Lordship, in the result, said he accepted the evidence of the plaintiff, and gave judgment for him for the amount claimed with costs. The defendant's counterclaim for £500 alleged balance of the £750 for shares was dismissed also with costs.

Fine for "Wire Tapping."

Richard Hodkin, labourer, Hartington Colliery, Staveley, was fined 20s. at Chesterfield, on March 18th, for tapping an electric cable to get light in a dirt tip cabin. George Bradshaw, electrician at the pit, said if Hodkin had tapped the high instead of the low-pressure wire he would have been killed. —*Sheffield Independent.*

Sentence.

At the Mansion House, last week, before the Lord Mayor, James Young, porter, and John Sheldrake, painter, were charged with being concerned in breaking and entering 106, Upper Thames Street, and stealing 3,100 electric lamps, the property of the B.T.T. Electric Lamp & Accessories Co., Ltd. According to the *City Press*, the police were unable to produce any evidence of breaking and entering, and the accused were therefore charged with being concerned in the theft of the goods. Accused pleaded guilty. The Lord Mayor sentenced Young to six and Sheldrake to two months in the second division.

Compensation Award.

In the Mayor's and City of London Court, on Monday, Edward Crampton, of Silvertown, obtained judgment for £100 and 20 guineas costs as compensation for injuries which occurred to him owing to an accident happening while working for the India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd., in December, 1920. He was sawing some wood when his left hand was cut. The thumb of the left hand was cut off to the first joint.

Workmen's Compensation Case.

At the Birmingham County Court, on March 21st, a tramcar driver, G. L. Owen, sought, under the Workmen's Compensation Act, to secure the restoration of certain weekly payments, the respondents being the Birmingham Corporation. According to the *Birmingham Post*, in 1915, applicant was driving a tramcar on the Oozells route, when the brakes failed. The car left the track and collided with a standard and overturned. As a result three persons were killed and 25 injured. Applicant received medical treatment until July, 1916. From the date of the accident to June 19th, 1916, he was paid 19s. a week compensation. Payment ceased upon an agreement for a declaration of liability being recorded. In November, 1921, there was a reorganisation of the department, and applicant was employed as a night watchman. He continued to work for the Corporation until January 5th, 1922, when he reported sick. The respondents denied liability on the ground that any incapacity was due to the accident. His Honour found for applicant and awarded him compensation at the rate of 20s. a week.

BUSINESS NOTES.

The Easter Holidays.—Owing to April 14th being Good Friday, the issue of the Electrical Review due to appear on the afternoon of that day will be published at 9 a.m. on Thursday, April 13th. All editorial matter for that issue should therefore reach us considerably earlier than usual. The advertisement department asks that new copy (with blocks) and alterations to existing displayed advertisements should be delivered at Ludgate Hill not later than the morning of April 6th (next Thursday). Official notices and small prepaid advertisements can be received up to 5 p.m. on Tuesday, April 11th. For the issue of April 21st, new copy and blocks must be received by the morning of Wednesday, April 12th.

Dissolution of Partnership.—Kingham & Purcell, electrical engineers and contractors, 75, Pasture Road, and 176, Boothferry Road, Goole.—Messrs. W. A. Kingham and S. A. Purcell have dissolved partnership. Mr. Purcell will attend to debts.

Bankruptcy Proceedings.—John Glyn Williams, colliery electrician, Duffryn Cymmer, Port Talbot.—Bankrupt appeared at Neath bankrupty court on March 21st for his adjourned public examination. The Official Receiver reported that the debtor had now submitted amended accounts showing gross liabilities amounting to £8,155 and assets of £49. After questioning debtor about numerous items in the accounts the Official Receiver asked for the examination to be adjourned for the signing of the notes.

Graham Moore Hallett, 7, King Street, Frome, Somersetshire, electrical engineer.—The first meeting of the creditors was held on March 22nd at the Official Receiver's offices, 26, Baldwin Street, Bristol. The statement of affairs showed ranking liabilities of £880, against assets of £378, or a deficiency of £522. Debtor attributed his failure to loss of contracts through lack of experience in estimating, depreciation of stock through falling markets, and bad trade. It appeared that he started business about six months after leaving the Army in October, 1918. He became aware of his position in December last. The creditors decided to appoint Mr. Emett, of Nicholas Street, as trustee of the estate. The following are creditors:—

	£		£
Callender's Cable Co. ...	64	Metal Agencies, Ltd.	14
Drake & Gorham	40	Metropolitan-Vickers, Ltd. ...	20
English Electric & Siemens Supplies	26	Potter's, Ltd.	288
King (J. C.) & Co.	12	Russell (T.) & Co., Ltd. ...	23
General Cable Co.	19	Simpson, Baker & Co.	54
Hallett, Mrs.	40	Elco Electric Manufacturing Co.	16
Bankers	71	Strickland, E. R.	10
		Ward & Goldstone	17

A. T. Williams and W. J. Bevan, electrical and general engineers, 49, Commercial Street, Aberdare.—A meeting of the creditors was held at the Official Receiver's office, Cardiff, on March 22nd. The liabilities expected to rank for dividend were set down at £1,708 and the assets at £436. Debtors attributed their failure to depression in trade, keen competition and losses on contracts.

W. J. Dicken (W. Dicken & Son), electrical engineer, 2, Upper High Street, Bargoed.—Receiving order made March 21st on debtor's own petition.

F. Rawcliffe (Frank Rawcliffe & Co.), electrical engineer, 8, Nun Street, Newcastle-on-Tyne.—Receiving order made March 21st on creditor's petition.

B. Barnett, electrical engineer, 104, Whitechapel Road, E.1. —Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C. Appointed March 18th.

Frederick Charles Goss, 64, Gloucester Road, Bishopston, Bristol, electrical engineer. The following are creditors:—

	£		£
Bristol Corporation (Electricity Department)	17	Hart Accumulator Co., Ltd. ...	130
B.E. Co. (Lincoln and Birmingham), Ltd.	13	Kear, S.	18
B.T.T. Electric Lamp Co. ...	23	Macintosh Cable Co., Ltd. ...	27
Bristol Times and Mirror, Ltd. ...	12	Metropolitan Vickers Electrical Co., Ltd.	54
Dodge, A.	10	Newtons, Taunton (Incorporated Estates, Ltd.), London	83
Edison Swan Electric Co. ...	37	Petters, Ltd.	38
Elco Electric Manufacturing Co., Ltd.	10	Russell & Co., Ltd.	163
Fuller's United Electric Works, Ltd.	22	Simpson Baker & Co., Ltd. ...	455
Graham, J. H., & Co., Ltd. ...	14	Wholesale Fittings Co., Ltd. ...	65
		Smith, D.	14

Company Liquidations.—Bedesco, Ltd.—Winding up voluntarily. Liquidator, Mr. A. E. Quaife, 155, Fenchurch Street, E.C. Meeting of creditors, April 3rd.

Hyde & Thomson, Ltd.—Winding up voluntarily. Liquidator, Mr. E. A. Leadbetter, 38, Church Street, Sheffield. Meeting of creditors, April 4th.

Butler & Spragg, Ltd.—Meeting of creditors, March 31st at 131, Edmund Street, Birmingham. Liquidator, Mr. R. A. Felton. The meeting is formal. All creditors are being paid in full. The liquidation is for the purpose of reconstruction.

Tinkers, Ltd.—Particulars of claims by April 24th to the liquidators, Messrs. F. Tinker and A. E. Chadwick, Daisyfield Boiler Works, Newton, Hyde.

Thanet Electric Co., Ltd., Margate.—The creditors were called together recently at the Institute of Chartered Secretaries, 59a, London Wall, London, E.C.2. It was reported that an extraordinary general meeting of the shareholders had previously been held in London, when a resolution in favour of voluntary liquidation was passed, and Mr. H. Kirby, of 840, Salisbury House, E.C.2, was appointed as liquidator. He stated that the liquidation was a formal matter, and the business had been purchased by a well-known trader at Margate, who intended to carry it on. The whole of the liabilities had been or would be paid in full.

Bombay Electric Supply & Tramways Co., Ltd.—Meeting, May 2nd, at 3 and 4, Clement's Inn, Strand, W.C., to hear an account of the winding up from the liquidator, Mr. F. C. Rimington.

R. B. Hand & Co., Ltd.—Meeting, April 26th, at Balfour House, Finsbury Pavement, E.C., to hear an account of the winding up from the liquidators, Messrs. P. J. Hooper and W. A. J. Osborne.

New French Companies.—La Société Fermière des Forces Motrices de la Garonne is the name of a new company which has lately been formed in Paris (82, Boulevard Haussmann) with a capital of 1,000,000 fr.

Reduction of Capital.—W. H. Dorman & Co., Ltd. and Reduced.—A petition for the confirmation of the reduction of the capital of the company from £700,000 to £437,000 has been presented to the High Court and will be heard by Mr. Justice Lawrence in London on April 4th.

Trade Announcements.—The address of Messrs. Heap, Digby & Riley has been altered to 91, Victoria Street, Westminster, London, S.W. 'Phone No. "Victoria 666"; Telegraphic address, "Grounds, Sowest, London."

Mr. Harold Parr, electrical engineer, has opened new premises at 1, Back Jane Street, off Station Square, Harrogate.

Mr. H. B. Turner, of 79, Playford Road, London, N.4, is to-morrow taking over the complete control of Messrs. Hall and Turner, wholesale factors of electrical goods, and he desires to receive price lists for cables, switches, lampholders, &c.

A partnership has been entered into between E. H. Phillips and Kent Bros. Electric Wire Co. as from March 1st, and has been registered under the title of Kent Bros. Electric Wire Co. & E. H. Phillips, for the manufacture and supply of silk, cotton, and enamel copper wires. Their London office is at 37, King Street, Covent Garden, W.C.2.

The Enfield Ediswan Cable Works, Ltd., have opened a branch office and depôt at 8, York Place, Leeds, under the management of Mr. G. H. Murphy.

Mr. G. Casperson, wholesale electrical factor, of 11 and 17, Upper Mill Hill, Leeds, has removed to 46, Park Square, Leeds.

Mr. H. A. Neale, having severed his connection with Neale and Freund, Ltd. (in voluntary liquidation) is now trading under the name of H. A. Neale & Co., and has taken offices at 116, High Holborn, London. He wishes to receive catalogues.

Catalogues and Lists.—Messrs. Gent & Co., Ltd., Faraday Works, Leicester.—An illustrated card dealing with "Pulsynetic" clock controls.

From the Metropolitan-Vickers Electrical Co., Ltd., we have received a wall calendar, with monthly slips, for the year ending March, 1923.

Messrs. James McMillan & Co., Clun House, Surrey Street, W.C.2.—An illustrated and priced pamphlet dealing with the "Telur" stop clock for controlling the length of trunk telephone calls.

Messrs. George Nobbs, Ltd., 89, Cleveland Street, Fitzroy Square, W.1.—Leaflet Y209, illustrating and describing "Genii Neptune" electric hot-water radiators.

The Suffolk Iron Foundry (1920), Ltd., Stowmarket.—An illustrated booklet dealing with welding rods and fluxes for cast iron.

Messrs. Moul & Co., Ltd., 43, Old Queen Street, S.W.1.—An illustrated folder dealing with the "Teletel" telephone call counter.

The Rawlplug Co., Ltd., Gloucester House, Cromwell Road, S.W.7.—A well-illustrated booklet giving full directions for the employment of "Rawplugs." Also a priced and illustrated leaflet.

Automatic and Electric Furnaces, Ltd., 231-233, Gray's Inn Road, W.C.1.—An illustrated leaflet inviting the reader to witness demonstrations of Wild-Barfield electric furnaces.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Engineering Department, Blomfield Street, London Wall, E.C.2.—Publication UKA, giving prices, sizes, and illustrations of malleable iron bonding clamps.

Messrs. Watts, Fincham & Co., Ltd., 22, Billiter Street, E.C.3.—Leaflet E8A, illustrating and describing the "Meyrick" conductor rail insulator.

Mr. H. C. Slingsby, 142-146, Old Street, E.C.1.—Design Chart No. 197, giving numerous illustrations of trucks, barrows, ladders, &c.

The Midland Electric Power Installation Co., Old Mill Street, Wolverhampton.—An illustrated leaflet showing a rewound 160-kW armature and advertising all kinds of electrical repairs.

Messrs. James Dawson & Son, Ltd., Lincoln.—An illustrated booklet giving particulars of the manufacture of "Lincona" balata belting.

Milling Electrical Co., 17, Whitefriars Street, London, E.C.4.—Brochure describing electrical organ-blowing equipments, made complete in the same works.

Private Arrangements.—W. L. Knight, trading as W. L. Knight & Son, 6, Oak End Ways, Gerrards Cross, electrical engineer.—A circular has been issued to the creditors of the above stating that a meeting was recently held, and an investigation into the position has now been completed by Messrs. Corfield & Cripwell, accountants. The statement of affairs prepared showed liabilities of £806, while, after allowing £46 for preferential claims, the assets were estimated to realise £331, or a deficiency of £475. With regard to the stock, this is stated to be of a very miscellaneous character, and at a forced sale might realise poorly. The book debts were owing from some 60 to 70 customers, and were all for small amounts. In accordance with a resolution adopted at the meeting, the debtor had executed a deed of assignment with Mr. W. A. J. Osborn as trustee. Mr. Osborn reports that the business is being carried on for the time being, pending an offer being made for the concern.

Australian Tariff Board.—The High Commissioner for Australia has been advised that the Commonwealth Tariff Board, created by the Tariff Board Act passed by the Federal Parliament last year, has now been constituted by the appointment of Mr. R. M. Oakley (chairman), Mr. Herbert Brookes, and Mr. Walter Leitch. Mr. Oakley is the Acting Deputy Comptroller of Customs; Mr. Brookes, who is a past-president of the Associated Chambers of Commerce of Australia, is the representative of the manufacturers; while Mr. Leitch, C.B.E., who was Australia's Director of Munitions during the war, and the first Director of the Commonwealth Bureau of Commerce and Industry, will represent the importers. The operation of the anti-dumping proposals of the Commonwealth Government, enacted in December last in the Customs Tariff (Industries Preservation) Act, will be the care of the new Board, and among its most important responsibilities will be that of advising as to the imposition of the duties provided for by that Act. The "dumping duties" are intended to prevent injury to Australian industries by the sale of goods from other countries at prices below the normal cost of their production. These duties will safeguard the manufacturing industries of Australia, that is to say, against the unfair competition of countries whose circumstances allow them to sell their goods at less than normal prices. As specified by the Australian Act, dumping duties are to be imposed in respect of goods exported to Australia and sold to an importer there at a price likely to be detrimental to an Australian industry—goods consigned to Australia which may similarly be sold there at less than a reasonable price—goods carried to Australia at freight rates which are lower than the prevailing rates—and goods sold to an importer in Australia at prices made possible by a depreciated rate of exchange in the country of export, whether those goods have been manufactured wholly or in part from material supplied from that country.

There is also an important provision for a "dumping preference duty" to be imposed on goods from foreign countries offered in Australia at *less than the fair market value of such goods as they are manufactured and sold in the United Kingdom.*

The Tariff Board will inquire into each case in question and will report to the Minister for Trade and Customs. Set up, also, to investigate the operation of the Australian Tariff, the detailed nature of which calls for an expert body of the kind, the work of the Board will include careful study of the effect of the Tariff upon industries, and it will advise the Government as to means for encouraging further development of those industries. Prominent among the matters it will handle are disputes arising out of interpretation of the Tariff; the necessity for new, increased, or reduced duties; and determination of the application of Australia's British Preferential Tariff, or the Intermediate Tariff; and it will deal with complaints as to unnecessarily high charges by manufacturers, or any action alleged to be in restraint of trade, to the detriment of the public.

The Tariff Board will make its recommendations to the Minister for Trade and Customs, and it will submit annual reports as to Tariff matters generally.

Openings for Trade in the Netherlands.—H.M. Consul-General at Rotterdam has forwarded to the Department of Overseas Trade extracts from the Dutch Press of recent dates, in which particulars are given of undertakings which may lead to openings for British trade:—

Electric Power Station (Zwolle).—The N.V. Electriciteitsfabriek "Ijsselcentrale" at Zwolle are drawing up plans for the extension of their power station. A large new boiler-house will be built. Work will commence in the course of this summer.

Tramway System in South Limburg.—The Limburgsche Tramweg Mij. (director, Ir. H. Ruijten, of Roermond; technical engineer A. P. Zuurendonk, Grasbroekenweg 4, Heerlen; engineer, J. M. Meijer, of Kruisstraat 26, Heerlen, have plans in hand for the laying down of a large tramway system in South Limburg, of which several lines will be put into execution this year. The work is to be dealt with by the above-mentioned Mr. Zuurendonk. Estimate for the whole system, which totals 180 k.m., amounts to 15,000,000 gulden.

Electric Works (Rotterdam).—It has been decided to build a rectifying installation with a capacity of 1,850 kW. Estimate for a rectifier of 850 kW, 70,000 gulden; motor generator of 1,000 kW, 65,000 gulden; switchgear, 26,000 gulden; divers, 89,000 gulden.

Electric Grinding Mill (Delft).—The firm of Aaldijk "De Groene Molen," of Zuidwal, Delft, intend converting their windmill into a mill driven by electric power. Work will probably commence this summer.

Boiler House (Groningen).—The "Provincial Electriciteitsbedrijf van Groningen" (Provincial Electric Supply Co.), of Groningen, intend extending their electric power station by building a big new boiler house. Work will probably commence next autumn.

Workmen's Shares in Supply Works.—The Rhenish-Westphalian Electricity Works Co., which is a joint private and municipal undertaking of Essen, is to raise its share capital by 400 millions to 550 millions of marks for the purpose, among other matters, of increasing the community of interests existing between the company and certain lignite and coal mines. Out of the total issue 25,000 registered shares for 25,000,000 marks are to be offered to the company's workmen in order "to make a practical attempt further to interest these circles in the undertaking."

French Competition.—Four prizes to a total of 30,000 fr., are offered by the city of Besançon, France, for plans for utilising the waters of the River Doub, which runs through the city, by means of a water-power generating station. Particulars may be obtained of the Mairie (town council).

German Trade Activity in China.—Information contained in the Intelligence Report for Changsha shows that German firms are re-opening and are making a keen bid for the recovery of their old footing in the trade of Hunan. Several German dye and electrical agencies have been started, and Germans are busily seeking financial support from the United States.

Carlowitz & Co. have re-opened premises in the Russian Concession, and have a large advertisement in the Chinese papers to the effect that the following agencies are held: Fried Krupp (steel and machinery), Ludwig Loewe (machinery), Lang (railway materials), Schule (flour and rice milling machinery), Garbe Lahmeyer & Co. (electrical supplies), Agfa (photographic chemicals), Henschel (locomotives), Zeiss (telescopes and school instruments), Pohlig (telegraphic and railway materials), Wanderer (motors and cycle), Deutsche Sprengstoff (mining explosives), Becker and Piscantor (stamping, weaving and mining machinery), Krause (printing machinery).—*British Chamber of Commerce Journal* (Shanghai).

Railways and Road Transport.—The Federation of British Industries has issued a memorandum in reply to the statement issued recently by the L. & N.W. Railway group supporting its claim for powers to run road transport independently of the railways. The trading community is apprehensive of the ultimate results of these powers, fearing that they may lead to complete monopoly. In any case it is considered that existing road transport concerns are not adequately protected in the Bill which the railway companies are promoting.

The Brussels Fair.—We have received from the Municipality of Brussels copies of a small leaflet inviting manufacturers to exhibit at the Fair which is to be held from April 3rd to 19th at the Parc du Cinquantenaire.

Scottish Electricians' Wages.—The Scottish Electrical Contractors' Association has offered to stabilise wages until the end of the year at the present rate of 1s. 7½d. per hour. The branches of the Electrical Trades Union have voted in favour of acceptance. The Union Executive will ratify the agreement accordingly. Over 2,000 men are involved.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in respect of goods and productions connected with the electrical trades and industries. Those who desire to enter an opposition to any of the applications have one month in which to do so from the date given below:—

Rotaloc. No. 417,662. Class 13.—Electric switches and fuses. Parminter, Hope & Sugden, Ltd., Hulme Electrical Works, Ellesmere Street, Hulme, Manchester. March 15th, 1922.

Watic. No. 421,178. Electrical goods in Class 16.—Laurence Maxwell Waterhouse, trading as the L. M. Waterhouse Electric Co., 19, Rathbone Place, Oxford Street, London, W. March 15th, 1922.

Airolite. No. 421,564. Class 16.—Windmill-driven electricity generating plants. Telford, Grier & Mackay, Ltd., 18, Billiter Street, London, E.C. 15/3/22.

Pasolite. No. 421,420. Class 13.—Electric and other lamps and electric switches. J. W. Pickavant & Co., Ltd., Quikko Works, Lombard Street, Birmingham. March 22nd, 1922.

South African Tariff.—The South African Customs authorities have recently given a decision to the effect that "automatic extension reels for electric lamps" are to be classified under No. 114b of the tariff, the duty being 3 per cent. in the case of foreign manufactures, British productions being admitted free of duty.

Copper and Lead Prices.—Messrs. F. Smith & Co. report March 28th:—Copper (electrolytic) bars, £65 15s., 35s. decrease; ditto ditto sheet, no change; ditto ditto wire rods, £75 15s., 35s. decrease; ditto ditto h.c. wire, 9 13/16d., 3/16d. to ¼d. decrease; silicium bronze wire, 1s. 1¼d., ¼d. decrease.

Messrs. James & Shakespeare report March 29th:—Copper bars (best selected), sheet and rods, no change; English pig lead, £23 5s., 10s. increase.

New Belgian Company.—There has been formed at Brussels the Compagnie Générale Industrielle Belgo-Polonaise for the manufacture of, and trade in, high- and low-tension electric conductors, hard and soft rubber for various uses, &c. The capital of the company is 250,000 fr.

Belgian Electrical Exhibition.—An exhibition of agricultural, commercial, and household appliances worked electrically is being arranged by the Société des Agriculteurs de l'Oise and the city of Compiègne for the period June 17th to 25th. It will be held on the borders of the devastated regions and in the centre of an important group of electricity undertakings, and hence will assume more than ordinary dimensions. Further particulars may be obtained from the Directeur des Services Agricoles de l'Oise at Beauvais.

Welsh National Exhibition Postponed.—The Secretary of the Welsh National Exhibition announced on March 22nd that circumstances had arisen which made it necessary to postpone the exhibition, which was to have been held at Cardiff from May to October next, until May-October, 1923.

Australian Patent Law.—In the *Board of Trade Journal* for March 23rd it is announced that a copy of the Commonwealth Patents Act, 1921, may now be seen in the Patent Office Library. The Act was passed on December 15th, and provides for the extension of the term of patents from 14 to 16 years, for the prolongation of the term of a patent where loss or damage has been caused by the war, and for other amendments of the principal Act.

The International Building Trades Exhibition.—The 13th International Building Trades Exhibition will be held at Olympia from April 11th to 27th. It will be opened by Mr. Paul Waterhouse, M.A., President of the Royal Institute of British Architects.

Book Notices.—*Year Book and Export Register of the Federation of British Industries*, 1922. London: Industrial Publicity Service, Ltd. 25s. post free.—This is a volume of considerable thickness, and it is divided into four main sections. The first gives a general survey of the scope and activities of the Federation of British Industries; particulars of the qualification for, and advantages derived from, membership; list of members of the Grand Council and Executive Committee; the grouping system; the Home Department; and the Overseas Department. In section II the manufactures and products of F.B.I. firms and associations are arranged alphabetically, with the names and addresses of the firms at home and overseas. Section III gives an alphabetical list of firms, together with a brief description of their business, head offices and works, cable addresses, also a list of associations that are members, with a statement of their objects, also lists of members of these Associations, such as the B.E.A.M.A., the Cable Makers' Association, &c. Section IV. consists of 340 pages of members' advertisements, amplifying the information given in the other sections.

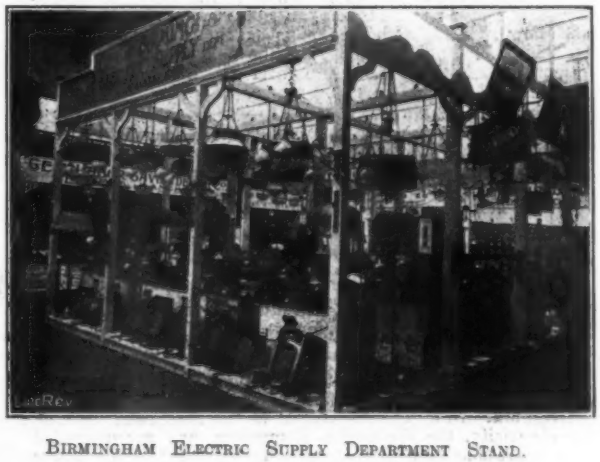
"Model Questions and Answers on the Thermionic Valve," by C. Jones. 44 pp., illustrated. Glasgow: J. Munro & Co., Ltd. Price 2s. 6d. net.

The *Bulletin* of the Hydro-Electric Power Commission of Ontario. Vol XI, No. 1. Toronto: The Commission.—This issue gives an account of the opening of the Queenston-Chippawa Development, and includes an article on "Service," as well as technical notes.

"Science Abstracts A. & B." Vol XXV, No. 290. Part 2. February 28th, 1922. Price 2s. 6d. each, and Indices to Vol. XXIV, sections A & B. Price 2s. 6d. London: E. & F. N. Spon, Ltd.

Journal of the American Institute of Electrical Engineers. Vol. XLI, No. 3. March, 1922. New York: The Institute. Price $1.

A Birmingham Exhibition.—The accompanying photograph gives a view of the stand of the Birmingham Corporation Electric Supply Department at the National Trades Exhibition, which remains open at Bingley Hall in that city until May 13th. The stand contains many examples of the latest applications of electricity to domestic uses, and is therefore of special interest to the numerous purchasers of houses and to architects and builders who have, at the present time, housing schemes in hand. There is a very large selection of table lamps, bronze fittings with ornamental shades, bowl fittings, fittings with rays to harmonise with different colour schemes, lanterns for shop lighting and signs, also an up-to-



Birmingham Electric Supply Department Stand.

date variety of electric radiators, fires, ovens, grills, hot plates, toasters, kettles, saucepans, irons, fans, water heaters and vacuum cleaners. The exhibits also include medical violet-ray apparatus, electric drills, electric blower for blacksmiths' hearths, "Fors" batteries, high-tension insulators, "Kaleeco" cables, specimens of various grades of cable, and a board showing different systems of wiring. The apparatus has been loaned by the British Thomson-Houston Co., Ltd., Callender's Cable and Construction Co., Ltd., General Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd., and the stand is being visited by large numbers of people every day.

Cranes, &c., for Canada.—The Department of Overseas Trade states that H.M. Trade Commissioner at Winnipeg reports that a Western Canadian firm requires particulars of electric cranes and other loading and unloading equipment for docks. Full details may be obtained from the department.

Patent Restoration.—An order has been made restoring patent No. 128,316, of 1917, granted to G. N. Autonoff for "Improvements relating to electric batteries."

For Sale.—The Marshal of the Admiralty Prize Court is inviting offers for 24 cases of hard fibre sheets, rods and tubes ex *Stanja*. Particulars from Messrs. Hale & Son, 10, Fenchurch Avenue, E.C. (See our advertisement pages today.)

Australian Works Closed.—The *Financial Times* reports that the new works of John Lysaght, Ltd., which were opened at Newcastle, Australia, on April 4th last year, have been closed down owing to the high cost of production, and 300 men from Newport and Bristol have been thrown out of employment. It is stated that the works were unable to compete with the imported article—galvanised iron and black sheets.

LIGHTING AND POWER NOTES.

Abercynon.—Electricity Supply.—The Mountain Ash Urban District Council has decided to introduce electric lighting in the Abercynon area. Negotiations have been entered into with the Merthyr Electrical Co. for a supply of electricity. Failing a satisfactory arrangement, the Council proposes to apply for sanction to install its own plant.

Ashford (Kent).—Application for Order.—The Urban Council has decided to apply for a Special Order for electric lighting.

Australia.—Tasmania.—According to the *Board of Trade Journal*, in the course of his recent introduction of hydro-electric works proposals in the Tasmanian House of Representatives, the Minister for Works stated that prior to making his 1919 statement the chief engineer and general manager of the Department had complete estimates prepared by the engineering officers of the Department on the basis of previous costs, in which it was shown that £2,500,000 would be required to complete the Great Lake Scheme to the stage when 50,000 h.p. could be delivered at Risdon, 10,000 h.p. at Electrona, 3,000 h.p. at Launceston, and 6,000 h.p. at Hobart, leaving 8,200 h.p. as spare, thus making a total of 57,200 h.p. delivered at the coast. Included in this estimate was a preliminary estimate of £250,000 for the Upper Shannon portion of the scheme, leaving an estimate for the net Waddamana scheme of £2,250,000. The revised estimate for this work shows that this figure will be exceeded by 25 per cent.; that is to say, it will now be £2,800,000. The amount already voted for the Great Lake scheme to date amounts to £1,977,500. The sum of £820,000 is being asked for this financial year to complete the Waddamana development. When the Waddamana power station is completed, and the new lines to Launceston and Risdon are finished, as they will be in August, the Department will be in a position to supply the Electrolytic Zinc Co. with 30,000 h.p., the Carbide Co. with 5,000 h.p., Launceston with 3,000 h.p., and the whole of the Derwent Valley, from and including Electrona, the Hobart district, Claremont, and New Norfolk, with all the power that may be required for the general public supply, and be able to connect to the system an additional 8,000 h.p. over the initial demand at any point at which it may be required.

Axminster.—Electricity Supply.—Messrs. Johnson and Phillips, Ltd., having been informed of a proposal to launch an electric lighting scheme in Axminster, have approached the clerk to the Urban District Council, stating that the cost of such an installation would be £5,000. The Council has decided to offer no opposition to the scheme.

Bedwellty.—Loan.—The Council has decided to apply for a loan of £7,000 for extensions to the electricity undertaking.

Bedworth.—Street Lighting.—The Parish Council has accepted the tender of the Leicestershire and Warwickshire Electric Light and Power Co. for public lighting for three years at £4 2s. 6d. per lamp.

Bradford.—New Plant.—The second 12,000-kW turbo-generator installed at the electricity works was formally started last week.

Brighton.—New Plant.—Owing to the increasing demand for electricity, the Electricity Committee has recommended that alterations and improvements to the plant at the power station be made at a cost of approximately £105,000, with an initial outlay of £85,000. It is proposed to install a new 6,000-kW turbo-alternator and a 4,000-kW turbo-generator at an estimated cost of £42,000, and it is recommended that application be made to the Electricity Commissioners for sanction to borrow that amount.

Cardiff.—Disclaimer.—The City electrical engineer (Mr. C. G. Morley New) states that the Special Order recently granted to the districts of Risca, Mynddislyn, and Bedwas does not concern the Cardiff Corporation. The consulting engineers for the scheme are Messrs. Arthur Ellis & Partners.

Continental. — Finland. — *Hufvudstadsbladet* is informed that the Finnish Government has entered into negotiations with a Belgian company, which is the owner of the Vallinkoski Falls, for co-operation as regards exploitation of the water power of the river Vuoksen, including the famous Imatra rapids. It is understood that the Belgian company will grant the Finnish State a loan of about ten million dollars. At present only about 14,000 h.p. is being utilised, while, according to the scheme adopted by the Government, an initial power of over 100,000 turbine h.p. would be obtained.—*Reuter*.

France.—The Compagnie des Forces motrices de la Basse Grosne (Seine et Loire) has applied for a concession to distribute electrical energy in the communes of Lux, Saint-Loup de Varenne, and Cevré. The Seyssel group of communes in the Ain department has received authority to construct and work an electric supply network for its district. The communal authority of Utell (Alpes Maritimes) has secured a concession for an electric distribution network.

In order to meet the increasing demand for electricity in the Rouen district, the Compagnie Centrale d'Energie Electrique is extending the Grand Quevilly power station by the addition of two turbo-alternating sets of 1,000-kW capacity.

Switzerland.—According to *The Times*, a new cable has recently been completed between Monthey (Valais) and Forclaz (Vaud). It is connected with the Friburg cables on one side and with the Monthey-Brigue cable on the other. The latter conveys electrical power of 45,000 h.p., and the surplus energy can thus be diverted over the Alps to the Friburg and Berne cables. The Monthey-Forclaz cable is the last of the four connecting the power stations on the south side of the Alps with those on the northern side.

Spain.—The Sociedad Fuerzas Motrices del Valle de Lecrin was formed in July last by the Tranvias y Ferrocariles electricos de Granada with the object of developing the waterfalls in the Valley of Lecrin for traction, lighting, irrigation, and industrial purposes. The first waterfall to be developed will be one on the River Durcal, of 4,000 h.p. capacity; the electricity generated will supply the stretch of country between Granada, Malaga, and Almeria. The company has already secured buyers for the whole of its anticipated output, and the works are expected to be finished by the autumn.

Corwen.—Water Power Scheme.—Colonel R. Vaughan Wynn has submitted to the ratepayers a scheme for supplying the town with electricity. It is proposed to utilise the Cynwyd Waterfalls, about two miles away.

Eston.—Electricity Supply.—The Urban District Council has decided, in face of much opposition, to proceed with an extensive electric lighting scheme.

Inverness.—Hydro-electric Scheme.—At a meeting of the Town Council on March 17th, the hydro-electric scheme was again discussed. It was stated that Sir W. G. Armstrong, Whitworth & Co., Ltd., were prepared to guarantee debentures to the extent of £130,000, but a further £100,000 would be required. The firm advised the postponement of further consideration of the scheme until November next, when the results of a further survey would be available. In reply to questions, it was stated that the scheme would be designed for an annual output of 1,425,000 units, and the price of energy would be about 6d. per unit for lighting and 2d. for power. A sum of £642 had already been spent in connection with the scheme. Treasurer Young said that a specific understanding with Sir W. G. Armstrong, Whitworth & Co. should be arrived at, and on his proposal the engineer was directed to submit a complete statement of the outlay up to date.

Leyton.—Proposed Sub-station.—The Urban District Council has received a letter from the Electricity Commissioners in regard to the application of the Council for sanction to borrow £34,454 for the erection of an electricity sub-station and for the provision of mains, plant, &c., for supply of electricity to the London County Council tramways, asking for a copy of the draft agreement with the London County Council and a detailed estimate of the financial result of the proposed expenditure. The Council has instructed the electrical engineer to prepare a statement.

Long Ashton.—Street Lighting.—The Parish Council has under consideration an offer from the North Somerset Electric Lighting Co. to light the village with electricity.

Newton Abbot.—Extension of Time.—The Urban District Council is applying to the Minister of Transport for an extension of time until July 23rd, 1923, within which time the Council may give notice to the Urban Electric Supply Co. under the Newton Abbot Electric Light Order, 1899.

Preston.—Order Approved.—The Corporation Electricity Order, 1922, has received the approval of both Houses of Parliament.

Loan.—The Town Council has decided to apply to the Electricity Commissioners for sanction to borrow £305,000 for the purchase of the undertaking of the National Electric Supply Co., Ltd., in pursuance of an agreement made on March 30th, 1921, and for the necessary expenses in connection therewith.

Price Reductions.—Reductions in the charges for electricity are to be made in the following districts:—Bedford, Dublin, and Hoylake.

Swansea.—Proposed Extensions Postponed.—A canvass of the residents at the Mumbles has been taken, and the result shows an estimated revenue of £1,750. The cost of extending the mains to Oystermouth and the erection of a sub-station is estimated at £16,000. The Council has decided that as the result of the canvass is unsatisfactory, the matter be deferred for three months.

Skipton.—Bulk Supply.—The Council has accepted the tender of the Western Electric Co., Ltd., for the supply and laying of cables, at a cost of £7,865, for a supply of electricity in bulk from Keighley.

Teignmouth.—Electricity Scheme.—The scheme for supplying the district with electricity is nearing completion. A contract for the mains has been placed for the first 1¼ miles of streets in the town, and it is anticipated that the Electric Lighting Co. will be in a position to supply electrical energy to consumers within three months.

Trelewis.—Electricity in Bulk.—Negotiations for a bulk supply of electricity from the South Wales Power Co. for the lighting of Trelewis and district have been completed by the local Council.

TRAMWAY AND RAILWAY NOTES.

Canada. — Hydro-Electric "Radials." — The *Electrical News* (Toronto) has published some criticisms by Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, upon the report of the Sutherland Committee appointed to examine the proposals to construct hydro-electric radials (*i.e.*, electrically-operated railways) in the province of Ontario. The Commission's report was inimical to the scheme, but Sir Adam states that its conclusions were based on inadequate information secured from witnesses who had only cursorily studied the proposals. He shows that the estimates of traffic possibilities put forward by one witness allowed for only one-tenth the volume of traffic upon radials already in operation in similar districts. In the matter of operating costs, Sir Adam Beck charges the Commission with having based its figures on statistics for 1919 and 1920, two abnormal years. In conclusion, Sir Adam states that whereas the Hydro-Electric Power Commission's investigations were carried out by experts, the Sutherland Commission discloses inconsistency and inaccuracy.

Continental.—Norway.—The *Board of Trade Journal* states that according to the recent Report on the Industrial and Economic Conditions in Norway, the electrification of the railway line from Christiania to Drammen is nearing completion, and it is hoped that it will be possible to open the section Christiania-Asker (about 26 km.) shortly. Work is proceeding upon the electrification of the Ofot railway (from Narvik to the Swedish border). The question of the electrification of other sections of railway is still under consideration.

Japan.—Tokio.—The first railless electric car is expected to be in operation by the end of April. The car will have no conductor, the passengers paying their fares at the exchange offices at stations.

Sunderland.—Strike.—The Ministry of Labour recently called a conference between the management and representatives of the employés of the District Tramways with a view to ending the strike which has been in operation for over a month past. The manager made several alternative suggestions, but all were rejected by the men, and the strike continues without any immediate prospect of settlement. The suggestion has been made that the local authorities in the district should take over the undertaking.

Uruguay.—Montevideo.—Despite formal protest by the British Foreign Office, the Municipality of Montevideo continues forcibly to control the funds of the British tramway company in that city. The municipality has extracted a further sum from the company's coffers to pay the increase in wages in respect of the first fortnight in March. In the House of Commons the Under-Secretary for Foreign Affairs stated that H.M. Government had protested against this arbitrary appropriation of British moneys. Although the Uruguayan Chambers recently resumed their sitting, the grant of permission to raise the fares is still withheld. Meanwhile the company is taking legal action against the municipality.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Sydney.—The Postal Department has introduced the Murray multiplex system, combined with Baudot printers, into the Sydney telegraph offices for communication with Melbourne. The system is to be extended to Brisbane shortly.

A large scheme of automatic telephone exchanges is in hand. It is proposed to erect a new exchange in South Sydney at a total cost of £368,240; one at East Sydney costing £195,880; and also three smaller exchanges.

Canada.—Winnipeg.—The *Electrical News* (Toronto) says that the Manitoba Telephone System has placed contracts for the conversion of two of the Winnipeg exchanges to automatic working. The Fort Rouge exchange is to be equipped by the Northern Electric Co., and Messrs. Siemens Bros., of Woolwich, have secured the contract for the St. John's exchange. Some 12,000 lines are involved, comprising two-thirds of the city's system.

Private Competition Forbidden.—A prominent officer connected with the Norwegian telegraph service states that, as the Government has a monopoly of the telegraph and telephone in Norway, it cannot allow private companies to establish a wireless telephone service to England in competition with the telegraph.—*Reuter.*

Siberia. — Telegraph Traffic.—Trans-Siberian telegraph traffic has now been opened. One message from Europe to Peking took twenty minutes, the regular commercial messages to Europe from Tientsin taking one hour and twenty minutes.—*Reuter* (Peking).

The Telephone Service.—New Cable to Northern Ireland. —A new submarine cable has been laid between Port Mora, Scotland, and Port Patrick, Donaghadee, a distance of 25½ geographical miles, and will shortly be put into service. This will provide two additional trunk circuits between Glasgow and Belfast. Continuous loading has been employed in this cable, and in addition to the two physical circuits, arrangements have been made for the superposition of a third "phantom" circuit.

Wireless Telegraphy.—Empire Press Union's Resolution. —At a recent meeting of the Council of the Empire Press Union, at which the President, Viscount Burnham, was present, a resolution was adopted urging upon the Government the necessity for improved telegraphic communications within the Empire, and advocating the carrying out of an Imperial wireless chain, which would meet with general approval from the Dominions immediately.

The "Watcher" System.—Strong protest against the continuance of the employment of wireless watchers has been made by the Association of Wireless Telegraphists, which alleges that the system is dangerous and inefficient. The Board of Trade Committee investigating the subject has not yet reported, although it has been sitting for some time.

Kenya Colony.—A start has been made on the Kenya Colony link in the Imperial wireless chain, and two experts, Commander Watson, R.N., and Major Ward, R.M.A., have arrived in Nairobi to institute preliminary investigations and tests as to the physical conditions prevailing in the country. A small test plant has already been erected on the proposed site at Thika, a small township about thirty miles from Nairobi, but it is believed that at least two years must elapse before active operations are commenced.—*Morning Post.*

Exhibition in Rome.—An exhibition of wireless telegraphy will be held shortly in Rome. Eighteen firms engaged in the manufacture of this class of apparatus will be represented, and different types of instruments, including the latest developments, will be shown working. Within the next few years this means of communication will undoubtedly be largely extended in Italy.—*Times Trade Supplement.*

Chile.—The *Board of Trade Journal* states that the Chilean naval authorities are instituting a wireless zone in the southern territories of the country for navigational purposes. The zone will contain eight stations; three of these are already working, but lack of funds has retarded the equipment of the others.

Australian Wireless Agreement.—Mr. Hughes, the Commonwealth Prime Minister, speaking at Melbourne on March 24th, said that the Parliamentary Committee, charged with the examination of the draft wireless agreement for the purpose of maintaining direct communication with Great Britain, had recommended certain alterations in the agreement. These alterations were designed, the Premier said, to strengthen the position of the Government. The Cabinet has agreed to the amendments, and the agreement will be signed and will take effect forthwith.—*Reuter* (Melbourne).

The agreement provides that the Government shall always hold a majority of the shares of the contracting company. That the company must not enter any combine, but remain an independent British business, and that the company must give preference to Australian goods and to returned soldiers. The proposed wireless rates are: full rate, 2s. a word; deferred, 1s.; week-end, 6d.; Press, 5d.; deferred, 3d.—*Reuter.*

An *Exchange* telegram states that the Commonwealth will subscribe £500,001. The company takes over the existing Australian radio stations, and three high-power stations are to be erected within two years in Britain, Australia, and Canada, to provide direct communication, also feeder stations to connect capital cities.

A New Swedish Station.—It is reported from Stockholm that plans for a new great wireless station in Sweden have now been completed, and that these, together with an offer made by the Radio Corporation of the United States, have been placed before Parliament for consideration.

Switzerland.—According to the *Wiener Zeitung*, a Marconi company has been formed in Switzerland which will take over the wireless traffic between that country and the outside world. The capital of the company is 18 million Swiss francs in 500 fr. shares. The company will be worked on a mixed system, whereby the State will become a shareholder, taking a considerable part of the gross receipts and half the net profits

over 8 per cent. The promoters are, besides the Marconi Co. of London, a Swiss group under the leadership of the Swiss Dispatch Agency and another group dominated by the Swiss Bankverein.

Wireless Telegraphy.—South Africa.—The Government of the Union intends to establish a wireless station for the purpose of inaugurating an adequate service with other countries, and is considering several schemes with this end in view.

An international wireless telegraph conference was opened at Cannes on Tuesday last, with Signor Marconi as president. —*Reuter.*

Wireless Telephony.—Calls from Aeroplanes.—The *Daily Mail* states that a regular commercial wireless telephone service—the first of its kind—is to be put into operation in the next few weeks linking up the cross-Channel aeroplanes direct with the offices of telephone subscribers in London. Recognition of this service as a regular public telephone call system is to be given by the General Post Office.

The necessary apparatus is being installed at the London Air Station at Croydon, and the general idea is that each aeroplane passenger, while crossing the Channel, will be allowed two wireless telephone calls per journey. He will be able to call up and speak direct to his office in London; or it will be possible for him to be called up direct from his office in London.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Ashton-under-Lyne.—April 12th. Electricity Department. Eight 6,600-V equipments. (March 24th.)

Australia.—Melbourne.—May 11th. Victorian Electricity Commissioners. 960 miles of aluminium steel-cored cable; 3,000 lb. flat armoured wire; 4,000 lb. No. 4 tie wire.—*Reuter's Trade Service* (Melbourne).

July 5th. Victorian Railways. One 2-ton storage battery truck with jib crane and lifting magnet.—*Reuter's Trade Service* (Melbourne).

Brisbane.—April 25th. Met. Water Supply and Sewerage Board. Electrical equipment pumps, transmission line, &c. (See this column in our last issue.)

Bedford.—April 5th. Electricity Department. E.h.p., h.p., and l.p. underground cables for 12 months. (March 24th)

Belgium.—Municipal Authorities of Rhisne (Province of Namur). Establishment of a system of electricity supply mains in the town.

April 7th. The Brussels Municipal Authorities. Cables and accessories required in connection with the electricity supply undertaking up to the end of the present year (102,000 metres armoured cable). Particulars for 2 fr. from the Service d'Electricité, 11, Rue Sainte-Catherine, Brussels.

May 10th. The Société Nationale des Chemins de Fer Vicinaux, 14, Rue de la Science, Brussels. Supply and laying of armoured underground cables and special returns for feeding the lines in the North Antwerp group of local railways. Particulars may be obtained for 3 fr. from the above address.

Birmingham.—April 7th. Electric Supply Department. Electric motors ranging from ½ b.h.p. to 15 b.h.p. (approximate number required 100). (See this issue.)

Douglas (Isle of Man).—April 10th. Corporation. Six miles l.p., three-core, lead-covered cable, distribution pillars, service material, meters, &c. (March 24th.)

Dundee.—April 20th. Electricity Department. One 12-panel d.c. switchboard, four 3,000-amp. d.c. circuit-breaker panels, and three starting panels for rotaries. (March 24th.)

Edinburgh.—April 10th. Electricity Supply Department. Coal for six or twelve months. Forms from Engineer.

April 4th. Tramways Department. One 5-cwt. pneumatic power hammer, with electric motor and starter. Particulars from tramway manager.

Falmouth.—Trustees of the Wesley Church. Designs and estimates for electric lighting installation. (See this issue.)

Hornsey.—April 20th. Electricity Department. One cooling tower. (See this issue.)

India.—April 7th. Inert electric cells, Leclanché cells and spare parts. (March 24th.)

London.—Wandsworth.—April 12th. Board of Guardians. Installation of electric lighting and fire alarms at the Swaffield Road Schools. (March 24th.)

Stepney.—April 20th. Electricity Supply Department. Three 1,000-kW converting plants and one 50-ton electrically-driven overhead gantry crane. (See this issue.)

Loughborough.—April 14th. Electricity Department. E.h.p. switchgear, and extensions to d.c. switchgear. (March 24th.)

Rhondda.—April 12th. U.D.C. Wiring and E.L. fixtures for 42 houses at Penygraig. Specifications (21s.) from the manager, Electricity Works, Porth.

Walthamstow. — April 12th. Electricity Department. E.h.p. feeder cable and l.p. distributor and public lighting cables. (March 24th.)

Warrington.—April 18th. Electricity Department. H. and l.p. paper and lead covered cable. (See this issue.)

Wolverhampton.—April 12th. Board of Guardians. Electric lighting installation at the Institution, Heath Town. (March 24th.)

CLOSED.

Belgium.—Eight Belgian firms competed for the Ghent municipal contract for four electric cranes for the Port of Ghent; the prices ranged from 135,000 fr. to 249,875 fr., the lowest offer being that of the Société Metallurgique-Electrique, of Brussels.

Three concerns—including one from Czecho-Slovakia—submitted tenders to the Belgian Post and Telegraph authorities in Brussels for the supply and laying of telephone cables in the Antwerp district. The lowest quotation (620,969 fr.) was that of M. E. Janssens, of Schaerbeek, Brussels.

Portsmouth.—Board of Guardians. Accepted:—
Electrical fittings.—Mr. J. Southey.

Skipton.—Electricity Committee.
Supply and laying cables for bulk supply from Keighley, £7,865, conditional on their paying not less than district standard rate for labour; to their employing not less than 90 per cent. of labour required from amongst Skipton unemployed; and to the free maintenance clause in the specification being extended for a period of five years from the completion of the work.—Western Electric Co., Ltd.

Wakefield.—Education Committee. Accepted:—
Alterations to Thornes House, electrical work.—Mr. W. Robb.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Saturday, April 1st. At Albemarle Street, W. At 3 p.m. Lecture on "Radio-Activity," by Sir Ernest Rutherford, F.R.S. (Lecture V.).
Friday, April 7th. At 9 p.m. Lecture on "The Evolution of the Elements," by Sir Ernest Rutherford, F.R.S.

Chief Technical Assistants' Association.—Saturday, April 1st. At Anderton's Hotel, Fleet Street, E.C. At 3 p.m. Paper on "Electric Vehicles," by Mr. J. D. Sparks.
Saturday, April 8th. At the Engineers' Club. At 7 p.m. Annual dinner.

Society of Engineers.—Monday, April 3rd. At Burlington House, Piccadilly, W. At 5.30 p.m. Paper on "Fractures in Concrete," by Mr. H. Bentham.

British Electrical Development Association.—Monday, April 3rd. At the Farmers' Club, 2, Whitehall Court, S.W.1. At 4 p.m. Paper on "Electric Power as an Aid to Agriculture," by Mr. R. Borlase Matthews.

Roentgen Society.—Tuesday, April 4th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 8.15 p.m. Ordinary scientific meeting.

Dynamicables.—Tuesday, April 4th. At the Trocadero Restaurant, Piccadilly. Anniversary dinner.

Institution of Civil Engineers.—Tuesday, April 4th. At the Institution, Great George Street, S.W. At 6 p.m. Paper on "Corrosion of Ferrous Metals," by Sir R. A. Hadfield, Bart., F.R.S.

Institute of Cost and Works Accountants.—Wednesday, April 5th. At the Institute of Patent Agents. At 7 p.m. Paper on "Debatable Points in Works Accountancy," by Mr. R. J. H. Ryall.

(Birmingham and District Branch).—Friday, April 7th. At the Chamber of Commerce, New Street. At 7.30 p.m. Paper on "The Function of Works Accountancy," by Mr. J. A. Lacey.

Chemical Society.—Thursday, April 6th. At Burlington House, W. At 8 p.m. Ordinary meeting.

Belfast Association of Engineers.—Thursday, April 6th. At the Municipal College of Technology. Annual general meeting.

Institution of Electrical Engineers.—Thursday, April 6th. At the Institution, Victoria Embankment. At 6 p.m. Adjourned discussion on Mr. R. Borlase Matthews's paper on "Applications of Electricity to Agriculture."

(North-Western Centre).—Tuesday, April 4th. At the Engineers' Club, Manchester. At 7 p.m. Paper on "Protective Apparatus for Turbo-alternators," by Mr. J. A. Kuyser.

(Western Centre).—Monday, April 3rd. At Swansea. Ordinary meeting.

(South-Midland Centre).—Wednesday, April 5th. At the University, Birmingham. At 7 p.m. Ordinary meeting.

(South-Midland Centre, Students' Section).—Tuesday, April 4th. At the Grand Hotel, Birmingham. At 7.30 p.m. Lantern lecture, "With the Wireless Signals Co., R.E., in East Africa, 1916-1918," by Mr. J. A. Cooper.

(Wireless Section).—Wednesday, April 5th. At the Institution, Victoria Embankment, W.C. At 6 p.m. Paper on "Provision of Power for Wireless Telegraphy," by Capt. J. H. Whittaker-Swinton, R.E.

British Science Guild.—Thursday, April 6th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 3 p.m. Annual meeting. May 23rd, annual dinner.

Optical Society.—Thursday, April 6th. At the Imperial College of Science, South Kensington. At 7.30 p.m. Ordinary meeting.

Edinburgh Electrical Society.—Friday, April 7th. At the Philosophical Institute. At 8 p.m. "Notes on a.c. and d.c. Plants," by Mr. J. Walker.

Junior Institution of Engineers.—Friday, April 7th. At Caxton Hall, S.W. At 8 p.m. Lecturette, "Engineering in Southern Persia," by Mr. J. W. Maple.

Birmingham and District Electric Club.—Saturday, April 8th. At the Grand Hotel, Colmore Row. At 7 p.m. Paper, "Notes on Marine Salvage," by Mr. V. H. Pearson.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

To enable us to complete replies to queries received this week, we need the names of suppliers or manufacturers of :—

McIntyre jointing sleeves (suitable for aerial cables).
"Big Brute" test clips (American-British agents' name wanted).
Aurorascope G.P. pocket throat and ear outfit used by doctors and dentists.
Telephone cord terminal tags (small terminals for fitting to ends of telephone cables).
"Meirowski" insulating material.
"Flail" electric fans.

NOTES.

The E.W.F. Scottish Section.—The first annual dinner of the Scottish Section of the Electrical Wholesalers' Federation, Ltd., was held at Glasgow on March 24th, Mr. Brown, chairman of the Section, presiding. Among the invited guests were Mr. Morgan, of the Glasgow Corporation (deputising for Mr. Mitchell, who had a prior engagement); Mr. Ure, representing the Scottish Contractors' Association; and Mr. McArthur, representing the manufacturers. A long toast list was gone through, intermingled with a first-class musical programme. The speeches struck the note that all sections of the electrical industry, manufacturers, factors and contractors, should work together for the common good. The Dinner Committee, consisting of Messrs. Fotheringham, Service, Munro, Holman, and Yuille (secretary) was cordially thanked.

Electricity Supply Regulations.—We have received a copy of the Regulations of the Electricity Commissioners for securing the safety of the public and ensuring a proper and sufficient supply of electrical energy, 1922 (H.M. Stationery Office, price 4d. net). Except for the substitution of the Electricity Commissioners for the Board of Trade and other verbal alterations to suit the new conditions, the regulations are identical with those issued by the Board of Trade in 1909.

Efficiency of Large Steam Turbine.—Recent tests made on the 60,000-kW cross-compound, triple-cylinder steam turbine installed in 1918 at the Seventy-fourth Street station of the Interborough Rapid Transit Co., show that a steam consumption of 11 lb. per kilowatt-hour can be obtained under normal conditions. The highest Rankine and thermal efficiencies obtained were 76 per cent. and 25.1 per cent. respectively. With the high-pressure turbine and one low-pressure turbine in service, the lowest consumption was 11.25 lb. per kilowatt-hour. When operating in this way the consumption is better than that for the complete set at loads below 25,000 kW. The 60,000-kW turbine is of the Westinghouse type, consisting of one high-pressure and two low-pressure elements, each element driving a separate generator. The normal steam pressure at the throttle is 220 lb. absolute with a superheat of 150 deg. Fahr., exhausting into a vacuum of 29 in. referred to a 30-in. barometer at 58.1 deg. Fahr. The speed of all three elements is 1,500 r.p.m.—*Electrical World.*

The Transmutation of Tungsten.—The *Daily Mail* recently reported that two Chicago chemists had succeeded in converting tungsten into gaseous helium by means of a high-pressure discharge which gave a temperature of 50,000 deg. F. Mr. H. F. Fratton has written to the *Daily Mail* stating that he and a colleague (Mr. E. S. Pangbourne) succeeded in doing this last December. They released a discharge at a pressure of 81,650 V into a tungsten lamp enclosed in an exhausted vessel. The lamp burst, with evidence of the generation of intense heat. Upon subsequent analysis of the remains no trace of tungsten could be found, but neon, argon, and a third unidentified gas were present.

New Electric Coaling Crane.—The official test of a new 30-ton 3-motor coaling crane built to the order of Ardrossan Harbour Co. by Messrs. Alex. Chaplin & Co., Ltd., cranemakers, Govan, has taken place. The crane was tested in all motions with full loads and then with 25 per cent. overload, and gave every satisfaction. This is the first electric coaling crane supplied to any of the Ayshire ports. The electric equipment is by the Electric Construction Company and Messrs. Edward Holmes & Co. The power is alternating current taken from Kilmarnock Corporation.

The I.E.E. Commemoration Meetings.—We have received a number of applications for reprints of the portraits reproduced in our articles on the jubilee of the Institution of Electrical Engineers, but not, at present, sufficient to justify further action. However, our offer (p. 343) holds good, and will be kept open so that readers who are interested, but have not remembered to write to us on the matter, will have a further opportunity of doing so.

The Styrian Hydro-Electric Scheme.—The Styrian Water Power and Electricity Co., Ltd., of Graz, Styria, has forwarded a reply to the statements made in the article entitled "A Large Styrian Hydro-Electric Scheme," which was published in this journal on January 13th, 1922.

As to the disappointment manifested in the article that only a small part of the comprehensive scheme outlined was to be put in hand at first, the company states that the principal difficulties lie in a financial direction. Expressed in Austrian currency, the expenditure on the works would amount to milliards of Austrian crowns (kronen), and possibly be increasing day by day, although it might not advance in a stable currency. The directors say that they know from experience that no foreign investors would participate in such an undertaking unless Austrian capital were to set a good example in this respect. When the new types of issues of ordinary and preference shares and 5 per cent. debenture stock have proved satisfactory to Austrians, the directors state that foreign investors will not fail also to become interested in the undertaking; indeed, the rate of construction will depend principally on the participation of the latter. At all events, the larger works embodied in the general scheme will not be begun until the smaller ones have yielded satisfactory working results.

The letter then proceeds to consider the question as to whether it would be possible for the company to supply energy at sale prices which would permit it successfully to compete with foreign coal as a source of energy, with petroleum or with native lignite, and also allow the company to pay 6 per cent. on the share capital, reckoned in a stable currency. On these points the directors state that owing to the depreciation of the Austrian crown the results from the calculations made by the experts are constantly varying, and for this reason it was impossible to mention in the prospectus the future costs of production and the presumed selling price. They say, however, that during last summer the sale price for electric current was 10 Austrian crowns per kW-hour, whereas in the middle of March, 1922, it was 200 crowns per kW-hour. The only definite result of all the calculations is that water-power energy will cost half the price of that of energy from steam power generating stations.

Pursuing this point, the letter remarks that foreign investors in countries having a stable currency will readily agree to this contention, as the chief item of expense in hydro-electric plants depends upon the cost of construction. In Austria this is said to be below the world parity. On the other hand, the current derived from steam power generating stations depends upon the price of coal, petroleum, &c., but as coal and petroleum have to be transported over long distances on foreign railways, neither fuel is likely to become cheaper in Austria, while the enormous shortage of pit coal in Austria will not permit of any large reduction in the price of native lignite in that country.

The communication further states that it is highly probable that Austrian consumers will be able to pay for electrical energy at the price which is being calculated at the present time, which is below the world parity, and also to pay the interest in a stable currency, as they would receive the energy at a lower price than they could obtain a supply from any new works elsewhere.

As to the question of contracts for the supply of energy, the letter says that the company is not to start any new works unless a sufficient number of prospective consumers agree to pay the rates fixed by the tariff, thus enabling the company to fulfil the pledges given in the prospectus.

The company's reply does not seem to call forth many observations. As consumers are to be offered energy at a price lower than that which would have to be paid for steam generated electricity, and presumably at a lower price than the cost of the production of power by the use of pit coal, lignite or petroleum—which price is to include the addition necessary to pay a rate of interest of 6 per cent. on the ordinary shares in a stable currency—such a tariff should encourage prospective consumers to come in and soon place a full load on the capacity of the plant of the initial station on the Lower Teigitsch.

At the same time, it is a pity that the company, in its reply, has not mentioned the total amount of the subscriptions already received in Austria in response to the recent invitation or invitations for capital.

A "Lightning Generator."—By means of apparatus which will give a momentary discharge of 10,000 amp. at 120,000 volts, Dr. C. P. Steinmetz, chief consulting engineer of the General Electric Co. (U.S.A.), and his co-workers, Messrs. J. L. R. Hayden and N. A. Lougee, have been able to reproduce lightning on a small scale, and thus test the performance of apparatus and objects when subjected to this phenomenon. In the tests which have been made with lightning arresters it has been found that their occasional failure to function properly is due to causes far different from those heretofore imagined. The apparatus consists essentially of 200 large glass plates arranged as a condenser for charging with rectified high-voltage electricity. Although the power and voltage behind the discharge produced are only one five-hundredth of the values for natural lightning, this apparatus will shatter blocks of wood and tree branches. There are prospects of making a still more powerful lightning generator.—*Electrical World.*

The Synchronising Effect of two Adjacent Transmission Lines.—In an article published in the *General Electric Review* for March, Mr. T. Nishi, of the Imperial University of Tokio, Japan, discusses the mutual synchronising effect of three-phase transmission lines carried on the same poles. The effect was first observed in Japan on the system of the Inawashiro Hydro-Electric Co., which had two 110,000-V circuits on the same towers. When generators respectively connected to these lines were being synchronised, at no load, the synchroscope needle showed a tendency to slow down when passing the in-phase position and to swing rapidly past the 180-degree out-of-phase position, and when the frequencies approached equality the pointer stopped near the in-phase position, showing that the two generators tended to keep exactly in phase; when the generators were loaded the effect was not so noticeable. A similar reaction was observed on the system of the Southern Sierras Power Co., in California, but in this case the machines tended to keep exactly 180 deg. out of phase. In the former case the conductors of the same phase occupied positions diametrically opposite one another, whilst in the latter they were in the same relative positions. The author discusses the phenomenon on the basis of the capacities between the lines, and shows that the theory accounts for the results. Hence the best arrangement of the conductors on this score is that indicated in A herewith, as opposed to B.

2	3		3	3
1	1		1	1
3	2		2	2
A			B	

Electricity (Supply) Bill, 1922.—The Council of the Incorporated Municipal Electrical Association, representing undertakings that have capital involved to the extent of some £80,000,000, at a meeting on March 17th, considered the question of the Electricity (Supply) Bill, 1922, and in view of the very great importance which it attached to the early passage of this Bill, to facilitate the more rapid development of electric supply throughout the country, instructed the hon. secretary to send a copy of the following resolution, which was passed unanimously, to all members of the House of Lords:—

"That in the opinion of the Council of the Incorporated Municipal Electrical Association the Electricity (Supply) Bill, 1922, should be carried into law at the earliest possible date in the interests of the industry."

The committee stage of the Bill in the House of Lords has been postponed several times; it is now set down for Tuesday next, April 4th.

National Society of Inventors.—A public meeting of the above Society was held at the Chamber of Commerce, Birmingham, on Monday last presided over by Mr. H. E. Sutherland, when Major J. Hall-Edwards, F.R.S. (Edin.), &c., well known for his research work in connection with X-rays, delivered an able address on "The Society and its Possibilities." He emphasised the possibilities of a carefully thought-out scheme bringing together the inventor and the manufacturer, and preventing the loss of brilliant ideas which often fell through for want of scientific aid, and remained undeveloped for lack of funds on the part of the inventor. He also pointed out that very few inventions had been created by the manufacturer himself, the inventions of individuals being in the majority of cases acquired by the manufacturer at his own figure, which had been very small compared to the actual value and to the amount which could no doubt have been obtained for the inventor had he had the backing of a society. Moreover, the manufacturer, who had a problem to solve, by offering a reward for a solution would be able to set at work the brains of quite a number of inventors.

The Society is open to inventors, patent agents, solicitors (patent law), scientists and manufacturers, for their mutual benefit. The secretary can be communicated with through the Chamber of Commerce, Birmingham.

Works Magazines.—The beneficial influence of works magazines is fully recognised by the Industrial Welfare Society, and the second of a series of annual conferences of editors of these journals is to be held in the Society's offices, 51, Palace Street, Westminster, on April 28th. The conference will devote itself to the discussion of the essentials for success in works and staff magazines.

A Lecture on Lighting.—Mr. W. J. Liberty (Public Lighting Inspector of the City of London) gave a popular lecture on "The Romance of Artificial Lighting" at Herne Hill on March 14th. The lecture outlined the history of lighting from the earliest time up to the present day.

David Hughes's Experimental Apparatus.—In a letter to *The Times*, of March 28th, Mr. A. A. Campbell Swinton states that in addition to David Hughes's notebooks containing an account of his experiments in wireless telegraphy in 1879, which have recently been bequeathed to the British Museum, the Museum has acquired a further set of these notebooks, containing Hughes's own illustrated account of his invention of the microphone.

"Still more interesting is the fact that a search, suggested by myself to Colonel H. G. Lyons, of the Science Museum, made amongst the contents of a room full of Hughes's personal effects that for the last 20 years have been stored in a furniture repository in London, has revealed the existence of a number of electrical instruments, comprising the original first microphones invented by Hughes, and the actual apparatus with which he made his early wireless experiments, all obviously constructed with his own hands. The several instruments can easily be identified by the illustrated descriptions in the notebooks, and we thus have a collection of great historical and scientific interest, which, through the generosity of the Hughes trustees, has been presented to the Science Museum in South Kensington, where it will shortly be on public view."

Kinematograph Exhibition at Finsbury Technical College.—By permission of Mr. Catterson-Smith, chief electrical lecturer, the students and staff of the engineering faculty were again, on March 24th, able to enjoy an exhibition of industrial films kindly loaned by the British Thomson-Houston Co., Ltd., of Rugby. The first film illustrated the application of electricity in iron-ore mines and in the calcining operations preceding the smelting of the ore. The scenes showed the processes of drilling holes in the face of the ore for explosives, collecting the ore, taking the tubs to the station by accumulator tractors, hauling them to the surface by mining locomotives, and raising the ore into hoppers by elevators and thence by charging cars into kilns to be calcined. The various operations were electrically controlled, and this reduced the manual labour to a minimum. The scenes also showed the electric traction work, the lighting of the mines, the power station, the chemical laboratories, and several electrically driven accessories of the kilns. This film is the best and clearest yet produced in connection with this somewhat difficult subject. The second film, on "Electricity in Steel Works," dealt with the manufacture of steel from the raw material to the finished product and the processes involved in making steel wires and plates. It included excellent views of the furnace, the pouring of the metal, the soaking pits, the cogging and rod mills in operation. At the close of the lecture Mr. Catterson-Smith expressed thanks to the British Thomson-Houston Co., Ltd., and Mr. B. E. Williams, third-year electrical student, for their efforts in bringing about what had been a most instructive and interesting afternoon.

The Importance of the Spanish Language.—Senor Oscar Victor Salomon, Consul-General for Peru, writing under date March 20th from 36-37, Queen Street, Cheapside, to Mr. J. Landfear Lucas, of the Spectacle Makers' Company, says: "You are doubtless aware the Spanish language and literature is receiving full and generous attention at the English Universities, in fact, a sound and scholarly recognition. But when we come down to the schools the case is different. French, and German before the war, held the field in the schools, and Spanish has been left largely in the care of the foreign teacher who knows its value and coaches the aspiring City youth in his leisure hours. I do not think I can be contradicted when I say that in the main Spanish is a neglected language in the schools of this country. This statement, however, would not be true of the technical schools, which include both Spanish and Italian in many instances. I can only say, and with the strongest emphasis, that the vastness of the future commercial trade between this country and South America renders it absolutely imperative that wherever French is taught Spanish also should be taught."—*Financial Times.*

Appointment Vacant.—Switchboard attendant (75s. 6d.), for the Rawtenstall Corporation tramways and electricity departments. (See our advertisement pages to-day.)

Soft X-rays from Arcs in Gas Vapour.—The U.S. Bureau of Standards announces that experiments have been conducted in which soft X-rays, having wave lengths longer than those previously known, were produced and their wave lengths determined. According to the *Journal* of the A.I.E.E., the new X-rays differ in many ways from X-rays as ordinarily understood. Thus, all known substances, including even ordinary air, are opaque to the soft X-rays, which can only be detected by their effect upon objects located inside the vacuum tubes in which the rays are produced. All of the chemical elements can be made under proper conditions to give off radiations which are characteristic of the element. Some of the radiations are visible light, and some are in the range of X-rays. The radiations described are the softest, longest-wave-length X-rays characteristic of several of the elements. Measurements have been made in twelve different gases, and the experiments are of interest because they partially close the gap between visible light of the shortest and X-rays of the longest wave lengths previously made. It has been known for a long time that radio waves and light waves are both electromagnetic, differing only in wave length, and X-rays were found to be very short waves of the same kind. The radio waves ordinarily used are measured in metres, and there is only a very small gap between the shortest radio wave and the longest heat waves; the latter have a wave length of about 0.3 mm. From the longest heat waves down to ordinary light waves, which have a wave-length of a few ten-thousandths of a millimetre, there is no gap and, indeed, measurements in the ultra-violet have been extended down to wave lengths only a little longer than 0.00001 mm. There was, however, a gap between this and the longest known X-rays, which were a little more than 0.000001 mm. in wave length. The present measurements nearly close this gap, as some of the X-rays measured are of greater wave lengths than are the shortest ultra-violet radiations.

U.S.A. Insulated Wire and Cable Standardisation.—Insulated wire and cable constitute the biggest single item of manufactured electrical materials, their value being about 17 per cent. of the total value of all such equipment. There are something like fifteen specifications in wide use in the United States, and little has been done to co-ordinate them. It has, therefore, become a matter of concern to both manufacturers and users of wire to bring about some co-ordination, with the idea of establishing a definite set of American standards.

The first step was taken last winter, when the following ten organisations agreed to act as sponsors, under the auspices of the American Engineering Standards Committee, for a comprehensive standardisation of electric wire and cable for other than telephone and telegraph use: American Electric Railway Association, American Institute of Electrical Engineers, American Railway Engineering Association, American Society for Testing Materials, Associated Manufacturers of Electrical Supplies, Association of Edison Illuminating Companies, Association of Railway Electrical Engineers, National Board of Fire Underwriters, National Electric Light Association, National Fire Protection Association. These organisations enlisted the co-operation of several others, and created a comprehensive group of committees to handle the work. The other co-operating organisations are: Associated Bell Telephone Companies, Electric Power Club, Society of Automobile Engineers, U.S. Dept. of Commerce, U.S. Dept. of Navy, U.S. Dept. of War.

The first meeting of the Sectional Committee was held at the headquarters of the American Society of Mechanical Engineers on December 6th, 1921, when plans of organisation and procedure were adopted, officers were elected, and the work was definitely launched.

There are twelve technical committees to which specific phases of the work have been assigned. Like the Sectional Committee itself, they are made up of representatives designated by the various organisations concerned in the particular subject with which each committee deals. The committees are as follows: Definitions, Copper Conductors, Stranding, Rubber Insulation, Impregnated Paper Insulation, Varnish Cloth Insulation, Magnet Wire, Fibrous Coverings, Metallic Coverings, Standard Make-Ups, Export, Weatherproof, Heat Resisting, and Similar Materials. The number of engineers participating in the work is over 130.—*T. & T. Age.*

Motor-car Headlights.—Much attention is being devoted to the elimination of the dazzling effect of vehicle headlights. A new device, that is claimed by the *Daily News* to be effective, is the Pasolite, devised by Mr. J. W. Pickavant, of Lombard Street, Birmingham, and intended for use on any car with an electric light installation. It consists of an extra lamp placed upon the off-side running-board behind the wing, at a height of about 2 ft., and projecting a beam rearwards at an angle of 45 deg. to the side of the car. As a car or pedestrian approaches, a two-way switch is used to cut out or dim the headlights and bring the Pasolite into operation. The side of the car and the edge of the road are thus brightly lighted, and there is no "dark spot" for the driver of the oncoming car; indeed, his road ahead is lighted for some way by the other's Pasolite. A demonstration was given at Burford Bridge recently, when representatives of Scotland Yard and the Ministry of Transport were present. General approval was expressed.

INSTITUTION NOTES.

Institution of Electrical Engineers.—Amendment of By-Laws.—Two special general meetings of members were held on March 23rd at the Institution. The first was called to give formal approval to financial arrangements, while the second was asked to consent to certain amendments to by-laws. At the latter meeting the President briefly introduced the matter and moved the amendments, and Mr. J. B. Atkinson made an explanatory statement and seconded the resolution, which was carried unanimously. The alterations made fall under two headings: (*a*) Purely verbal alterations necessitated by the change of status of the Institution; and (*b*) Amendments involving questions of principle.

The expression "abroad" used in connection with the situation of members is defined as "outside great Britain, Ireland, the Channel Islands, and the Isle of Man." The correct form of description of each class of member is set out (with abbreviations), and it is to be noted that the use of the title "Chartered electrical engineer" has not been sanctioned by the Privy Council, and is therefore prohibited. To preserve the strictly technical character of full membership of the Institution the proviso that a person "so prominently associated with the objects of the Institution that his admission as a Member would . . . . conduce to the interests of the Institution," has been deleted. The power of expulsion is placed in the hands of the Council, with a right of appeal to a committee of three Past-Presidents. This is necessary in view of the small proportion of the membership which can possibly attend a general meeting. Certain alterations are made in the constitution of the Council. It is provided that instead of three Associate Members and three Associates serving on the Council the members shall be four and two respectively. The reason for this is the growth of the associate membership in proportion to the class of associate. The nomination of two candidates in excess of the number of vacancies by the Council is to be discontinued. Associate Members will in future be permitted to nominate Associate-Member candidates for the Council. The number of signatories to a member's nomination is to be limited to ten. The term "Local Centre" is to be the future designation of the provincial branches, in accordance with the expressed wishes of these Centres.

Mr. F. W. Purse expressed approval of the amendments, and said that many members were looking forward to yet another—the lowering of subscription rates.

Dr. S. Parker Smith said he would have preferred that the expulsion of a member should be left to a general meeting, as the Council would be placed in rather an invidious position in such a case. He would not, however, move an amendment.

Mr. C. le Maistre thought the change a good one, as it was preferable that such matters should be discussed privately.

Mr. F. C. Raphael, recalling a dispute of 10 years ago, welcomed the change in the nomination methods.

The President, while sympathising with Dr. Parker Smith's views on the expulsion of a member, was compelled to agree with Mr. le Maistre that privacy was desirable.

Altered Arrangements for Meetings.—The discussion on Mr. R. Borlase Matthews's paper on "Applications of Electricity to Agriculture" will be continued at the ordinary meeting to be held on April 6th. Mr. J. A. Kuyser's paper on "Protective Apparatus for Turbo-alternators" will be read and discussed on April 27th (instead of April 6th). The joint meeting with the Röntgen Society and the Electro-Therapeutic Section of the Royal Society of Medicine, previously announced for April 27th, has been postponed to a later date.

Informal Meeting.—At the final meeting of the session, on March 20th, Mr. F. Pooley was in the chair, and Mr. Arthur Wright opened a discussion on "The Importance of Considering Finance in Electrical Undertakings."

Mr. Wright thought the financial and legislative side was outside the scope of the practical man, but he hoped to show it was of the utmost importance, and should be studied, especially by the younger members, on whose shoulders the immense future of the industry would rest.

Mr. Wright said that general and cheap electricity supply was now recognised as the biggest national want of most industrial nations. We were passed by countries to-day having far higher costs of materials, wages, and brains than ours. The fire insurance rules in U.S.A. were much more drastic and arbitrary than ours. Northern Italy and Switzerland were much poorer, yet electrical development was going on there at a rate which in England would employ all our resources. The main cause of our being behind was the pernicious effect of the old Electric Lighting Acts and the parochial spirit of their purchase clauses. The present Government, realising this, was endeavouring to rectify some of the old defects, yet nothing was being done to remedy the real cause, namely, the discouragement of private capital and enterprise to enter the electricity supply field. Only private money and enterprise could be relied on for the big developments; ratepayers were not likely to allow their rates to be mortgaged for enterprises far away from their towns, and in which they would not have the sole vote in the management. Private financiers would not supply capital unless its expenditure was wholly under the control of men elected by them. In his conclusions Mr. Wright declared that although we had a friendly Government atmosphere and keen Commissioners, the move must come from the industry in the form of a united request for better encouragement of private enterprise.

Mr. J. S. Highfield (president), said that the present-day proposal was to set up Joint Electricity Authorities which were to raise money to carry out works. If they succeeded in this they would, in many cases, duplicate the work of the power companies and waste would result. If the money was obtained the proper course would be to buy out existing undertakings.

Mr. W. A. Chamen stated that about three times the amount of energy generated in South Wales by statutory authorities was generated by private industrial plants. This was often distributed over extensive areas by quite illegal wayleaves and periodically a large consumer was absorbed by the industrial concerns and taken off the supply company's mains.

Mr. E. T. Ruthven Murray spoke of the difficulty of charging a uniform rate to varying consumers where the conditions were often vastly different.

Mr. H. M. Sayers said that it was not true that the interests of the supply companies and the local authorities were antagonistic. The municipalities were co-operative concerns having the public services for the investment of their savings. The chief thing the supply companies required was security of tenure.

Messrs. W. E. Warrilow, R. J. Mitchell, J. D. Sparks, A. G. Hilling, E. W. Moss, R. W. Hughman, R. Grierson, and A. B. Eason also spoke.

Nottingham Society of Engineers.—At a meeting of the Society, on March 29th, Mr. James F. Driver, M.I.E.E., lectured upon "The X-Ray Examination of Materials." The lecturer described the nature of and method of producing X-rays, and then spoke of the examination of metals, welds, &c. The lecture was illustrated by lantern slides.

Chelmsford Engineering Society.—The principal feature of the Conversazione, held on March 18th, was an exhibition of numerous engineering and scientific devices, supplied by members and the Chelmsford engineering firms. Messrs. Hoffmann showed a number of heat-treatment arrangements and riveting machines, as well as gauges and measuring instruments. The Marconi Co. exhibited a variety of wireless apparatus, with which demonstrations were given; kinema films dealing with "wireless" matters were shown in a separate room. The various stages of dynamo manufacture were shown by Messrs. Crompton & Co.; this firm also displayed several kinds of switchgear and instruments. A number of Messrs. Crompton's employés demonstrated devices of their own. These included a soap film stretched by centrifugal force; colour photography apparatus; arc welding outfits; and a "vortex gun." The first part of the evening was devoted to an excellent concert.

Paisley Association of Electrical Engineers.—The Association held a successful smoking concert on March 17th. During the proceedings prizes were presented to junior members for papers on electrical subjects, and the chairman (Mr. W. R. Scott) briefly outlined the Association's work during the year.

Tramway Association Meetings.—The annual congress of the Tramways and Light Railways Association is to be held at Bournemouth on June 22nd and 23rd. Among the papers to be presented will be "Bournemouth Corporation Tramways," by Mr. I. Bulfin; "Railless Traction," by Mr. E. M. Munro; and "Modern Improvements in Rolling Stock," by Mr. C. J. Spencer.

The annual conference of the Municipal Tramways Association is to be held on September 13th, 14th, and 15th, at Newcastle-on-Tyne. The summer meeting of the Managers' Section takes place in Glasgow on June 15th and 16th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Mr. A. P. M. FLEMING, who is unquestionably our leading specialist in technical education and training in connection with electrical engineering, was born in the Isle of Wight in 1881. He received his engineering training at Finsbury Technical College in the years 1897 and 1898, and the following year he spent with the London Electric Supply Corporation, at Deptford. He was with Messrs. Elliott Bros., instrument makers, in 1900, and in the same year he crossed the Atlantic to join the Westinghouse Electric and Manufacturing Co., Pittsburgh, remaining there until 1902. In that year he entered the service of the British Westinghouse Co., Trafford Park, Manchester (now Metropolitan-Vickers Electrical Co., Ltd.) and has remained there until the present time. During this period of twenty years he was engaged for some years as the company's insulation specialist, dealing with all investigations relating to the manufacture and design of insulation, the testing of new materials, and the investigation of electrical failures. Subsequently he was appointed superintendent of the transformer department, and during the period from about 1906 to 1914 he was responsible for the design and manufacture of all types of transformers totalling some millions of kilowatts. He was also superintendent of the departments manufacturing insulating materials and electrical windings of all kinds during this period. He was responsible almost from the commencement of the British Westinghouse Co. at Trafford Park for the training of apprentices, and in 1912 he established the works school for the training of trade apprentices. This has grown from an original number of 100 trade apprentices to 650, and in addition there are now about 80 public or secondary school and 100 University men undertaking special courses of training. Since 1916 he has been manager of the research organisation of the company and also of its educational and training work, and during this time has designed and equipped extensive research laboratories on the works premises, as well as in certain of the associated companies. Mr. Fleming is the author or part-author of a number of books on subjects coming within the scope indicated by the above duties, and he has also read a number of papers before the Institution of Electrical Engineers, the British Association, the Manchester Association of Engineers, and various other educational and technical societies in different parts of the United Kingdom; also before Welfare Workers' Institute conferences and conferences of the various research associations. Mr. Fleming is a M.I.E.E. (he filled the chair of the North-Western Section in 1918); also a member of the American Institute of Electrical Engineers, the American Society for Testing Materials, the British Association, the Junior Institution of Engineers, the Manchester Association of Engineers, &c. He is a member of Council of the British Electrical and Allied Industries' Research Association and of many of its committees and sub-committees; chairman of the B.E.A.M.A. Education Committee; member of the Education Committee of the Federation of British Industries; member of the Board of Governors of the Manchester and District Armaments Scholarships Committee. He is a director of Messrs. B. S. & W. Whiteley, Ltd., manufacturers of Fullerboard and insulating sheet material, Pool, Leeds, and is a member of the Commission appointed in 1921 by the Secretary of State for India on Indian Students under the chairmanship of Lord Lytton. During the war he organised, at the request of the Admiralty, a body of scientists and manufacturers known as the Lancashire Anti-Submarine Committee, to conduct research regarding submarine detecting devices. He also organised the selection and training of the

Photo by] [*Lafayette.*

MR. A. P. M. FLEMING.

School of Listeners for employment on patrol craft for submarine detection. He received the degree of M.Sc.Tech. (Honoris Causa) of Manchester University in 1920; the honour of O.B.E. was conferred upon him in 1918; and he was made a C.B.E. in 1920. In 1915 Mr. Fleming undertook, on behalf of the consultative committee appointed prior to the establishment of the Department of Scientific and Industrial Research, an investigation into the research laboratories associated with various industries in the United States. As the foregoing notes will indicate, he has been closely identified with educational work connected with industry during the past twenty years. In addition to the educational activities of the Metropolitan-Vickers Co., he was joint organiser of the Engineering Training Organisation, which was finally taken over by the Engineering Employers' Federation.

The Times reports that the King has appointed Sir GERALD EDWARD CHADWYCK-HEALEY, Bt., C.B.E., to be a member of the Royal Commission on Awards to Inventors, to fill the vacancy caused by the resignation of Lord Rayleigh.

Mr. JOHN LITTLE, manager of the Manchester and Liverpool offices of Messrs. Cammell, Laird & Co., Ltd., who was returned to the Southport Town Council in November last as representative of the Middle Classes Union, has been appointed chairman of the Southport Corporation Electricity Committee.

The *Sheffield Independent* reports that the Chair of Civil and Mechanical Engineering in the University of Leeds will be vacant shortly, owing to the resignation of Professor J. Goodman, who has held the Chair since 1890. Professor Goodman proposes to give his time to research, and the University Council has assigned to him accommodation for this purpose.

Mr. A. G. MARSH is retiring from the board of directors of the Z Electric Lamp and Supplies Co., Ltd., in order to commence business as a wholesale electrical supplier and manufacturers' agent.

Mr. Clifford Mitchell, manager of the new works of the Marconi Wireless Telegraph Co., at Chelmsford, since they were instituted in 1911, has resigned from that position, and Mr. H. B. Tilley, assistant works manager for nine years, has been appointed in his place.

Mr. W. G. Hurst, engineer and manager Burnham and District Electric Supply Co., Ltd., has been appointed engineer and manager of the Teignmouth Electric Lighting Co., Ltd.

Mr. Arthur H. Short has been appointed to the position of engineer, secretary and manager of the Burnham-on-Sea, Somerset, and District Electric Supply Co. He was in charge of plant (600 h.p.) at Nobel's Explosives Co. during the war and until he resigned last year.

Obituary.—Mr. Richard Henry Rice.—We regret to learn from our transatlantic contemporaries that Mr. Richard Henry Rice, manager of the Lynn Works of the General Electric Co., from 1918 until his death, passed away suddenly from heart failure, while snow-shoeing at Bolton, on Lake George, N.Y., on February 10th. He was born in 1863. After engineering training and experience with various concerns, he became connected with the General Electric Co. as a consultant on steam engineering in 1903, and was for years in charge of the steam-turbine department of the Lynn Works. The *General Electric Review* mentions as a tribute to his originality that he had taken out more than 50 patents, but we are drawn to quote from the *Review* the following eulogium of the man himself by "J. R. H."—something which in the long run is more desirable than even his greatest scientific achievements:—

"What we really want to put on record is that we more than respected him—we loved him. Why is it that we have this feeling toward some men and not toward others? We have stated that Mr. Rice had lived a life that fulfilled our conception of what an engineer's life should be and we believe that that is why we loved him.

"He was clever—he was capable—he was a man of achievements—he was a conspicuously successful man in his profession—he was the chief of a large organisation of men. And yet Mr. Rice was simple, in the most charming sense of the word. He seemed to respect all men and to look for the good that was in them and all men respected him. He was democratic—he was kind. Whoever heard Richard Rice say a small or an unkind thing about another human being? Who remembers a mean or petty action of his?

"He gave more to the world than he attempted to take from the world. Some men take more than they give—he gave more than he took. He gave more in counsel—more in kindness—more in sympathy. He helped everyone he could help—every time he could help them. That is why his associates, companions and friends loved Richard Rice and why they so sincerely mourn his loss.

"Thank God that such men as he get to the top."

Mr. Nicholas Kilvert.—We regret to record that Mr. N. Kilvert, chairman of the Lancashire Dynamo and Motor Co., Ltd., passed away suddenly at his residence at Hale on March 24th. Mr. Kilvert, who was 63 years of age, was chairman of N. Kilvert & Sons, lard refiners, Trafford Park. Mr. Kilvert was one of the founders of the Lancashire Dynamo & Motor Co., Ltd., and chairman from its inception. He was also chairman of the Lancashire Ordnance and Accessories Co., of Stockport, and a director of Messrs. Browett, Lindley & Co., Ltd., of Patricroft. He was a vice-president of the British Electrical and Allied Manufacturers' Association. Mr. Kilvert was a very far-seeing man, and business-like in all his undertakings, which were very extensive. He always had the welfare of his employés at heart, was always accessible, and spent considerable sums in advancing their well-being.

Mr. E. H. Kannreuther.—The death is announced at Birmingham of Mr. Ernest H. Kannreuther, the Italian Consul in that city and head of the export merchant firm of Messrs. Kannreuther & Co., Ltd., of Birmingham, large exporters of general hardware, gas and electrical engineering equipment, &c. Mr. Kannreuther was honoured with the Order of the Crown of Italy for his work on behalf of that country.

Will.—The late Rt. Hon. F. Huth Jackson, banker, and a director of the Eastern Telegraph Co., the British Trade Corporation, and other companies, left £169,907 gross and £101,677 net personalty.

NEW COMPANIES REGISTERED.

North-Western Electrical Co., Ltd. (180,477).—Private company. Registered March 21st. Capital, £100 in £1 shares. To carry on the business of electrical engineers and contractors, &c. The first directors are: T. C. Hartley, 186, Salthouse Road, Barrow-in-Furness; J. T. Storey, 43, Raglan Street, Barrow-in-Furness. Qualification, 10 shares. Secretary: J. T. Storey. Registered office: 55, Strand, Barrow-in-Furness.

Automobile and Electrical Equipments, Ltd. (180,460).—Private company. Registered March 21st. Capital, £1,000 in £1 shares. To take over the business of suppliers and repairers of motor and electrical equipment for motor engines, cars and craft of all kinds carried on at 1 and 2, Marylebone Passage, Wells Street, Oxford Street, W., as the "Automobile Electrical Equipment Co.," and to adopt an agreement with C. de Winter and R. A. Roberts. The first directors are: R. Herbert-Smith, 24, Sedgeford Road, Old Oak Road, W.12, engineer; R. Cooke-Jones, 7, Celia Road, Tufnell Park, N.19, motor engineer (joint managing directors). Qualification, £50. Remuneration, £50 each per annum. Secretary (*pro tem*): R. Herbert-Smith. Registered office: 1 and 2, Marylebone Passage, Wells Street, W.1.

Grierson, Ltd. (180,410).—Private company. Registered March 18th. Capital, £10,000 in £1 shares (4,000 non-cumulative participating preference). To carry on the business of electrical and mechanical engineers, electricians, builders, contractors, manufacturers of and dealers in machinery, apparatus, equipment, lamps, illuminating devices, medical appliances and scientific instruments, kinematograph equipment, &c. The first directors are: J. L. Musgrave, "Heatherdene," Grove Park, Chiswick, W.4; R. G. Crittall, 33, Wickham Way, Beckenham (both directors of Richard Crittall & Co., Ltd.); E. Herring, 22, Keswick Road, East Putney, S.W.; P. M. B. Grenville, "Fairlight," Kingston Hill, Kingston, Surrey (both directors of J. Jeffreys & Co., Ltd.). Richard Crittall & Co., Ltd., and J. Jeffreys & Co., Ltd., may, whilst holding £500 shares, each appoint two directors. Qualification (except life or managing directors), £250. Registered office: 197, Wardour Street, W.

Norchard Syndicate, Ltd. (180,553).—Private company. Registered March 23rd. Capital, £1,000 in £1 shares. To construct, maintain and work electric generating stations, to produce and use electrical energy and supply the same to towns, collieries, buildings, factories, mines, railways, tramways and others, &c. The permanent directors are: W. T. Kerr, Netherwood, Tupsley, Hereford, electrical engineer; G. C. Woods, 3, New Court, Lincoln's Inn, W.C., solicitor. Qualification, £100. Registered office: 3, New Court, Lincoln's Inn, W.C.

Magneto, Accumulator and Generator Services, Ltd. (180,410).—Private company. Registered March 18th. Capital, £500 in £1 shares. To carry on business as mechanical transport ignition repairers, and any other branch of the electrical engineering trade; to act as receiving agents and further the interests of the Northern Motor Exchange, Ltd., in Newcastle-upon-Tyne and elsewhere. The first directors are: R. H. Johnson, 2, The Cedars, Sunderland, motor engineer (permanent); C. R. Burnham, 10, Azalea Terrace South, Sunderland, motor engineer. Qualification, 50 shares. Registered office: 4, Ridley Place, Newcastle-upon-Tyne.

United Wire Works (Birmingham), Ltd. (180,566).—Private company. Registered March 23rd. Capital, £120,000 in £1 shares (60,000 preference). To acquire from the United Wire Works, Ltd., the goodwill and certain of the assets and liabilities of the branch business of that company carried on at Birmingham. The subscribers (each with one ordinary share) are: H. C. Chambers, "Kerri," Blakesley Road, Yardley, Birmingham, solicitor's managing clerk; J. MacCormack, 1, York Drive, Glasgow, W., wire manufacturer. The holders of ordinary shares numbered 1 to 12,500 may appoint half the directors, and the holders of ordinary shares 12,501 to 25,000 may appoint the other half. Each such section may appoint the chairman in alternate years. No qualification required. Remuneration (except managing director), £800 per annum, free of income tax, divided between them. Solicitors: Pinsent & Co., Birmingham.

Motolite Dynamos, Ltd. (180,416).—Private company. Registered March 18th. Capital, £3,000 in 2,000 preference shares of £1 each and 4,000 ordinary shares of 5s. each. To carry on the business of dynamo manufacturers, electrical engineers, electricians, manufacturers of and dealers in motor accessories, &c. The first directors are: L. S. Challis, 6, Dungarvan Avenue, Putney, S.W.15, electrical engineer; H. C. Pontet, Spring Cottage, Landor Road, Shepherd's Bush, W.12, engineer; H. C. H. Smyth, 35, Cleveland Avenue, Chiswick, W.4, electrical engineer. Qualification, £100. Remuneration as fixed by the company. Registered office: Landor Road Works, Landor Road, Askew Road, Shepherd's Bush, W.12.

A. P. Maglen, Ltd. (180,568).—Private company. Registered March 24th. Capital, £100 in £1 shares. To carry on the business of manufacturers, importers, and distributors of electric lamps, electric light fittings, electrical appliances and apparatus, &c. The subscribers (each with one share) are: W. R. Preston, "Midlands," 2, Claremont Gardens, Surbiton, Surrey, company director; S. H. Buckland, 4, Regent Street, S.W.1, chartered accountant. W. R. Preston is the first and permanent director. Registered office: Sicilian House, Southampton Row, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Low Engineering Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital dated February 22nd, 1922, to secure £3,000. Holder: The Hon. C. N. Bruce, 1, Lowndes Square, S.W.

Spicer & Co., Ltd.—Issue on March 16th, 1916, of £600, and on August 15th, 1917, of £250 debentures, parts of a series (filed March 17th, 1922).

Evans (Electrical), Ltd.—Satisfaction in full on March 14th, 1922, of debenture dated December 14th, 1921, securing £1,100, filed. First and second debentures both dated March 14th, 1922, to secure £300 and £1,040 respectively, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: G. J. Gully, 35, Croydon Road, S.E., and E. J. Walker, Southbank, Ravensbourne Road, Bromley, Kent.

Lamp Manufacturing Co., Ltd. (76,151).—Return dated February 9th, 1922. Capital, £10,000 in £1 shares. 5,400 shares taken up. £5,400 paid. Mortgages and charges, £2,500 debentures.

Macintosh Cable Co., Ltd. (72,097).—Return dated January 3rd, 1922. Capital, £100,000 in £1 shares (75,000 ordinary and 25,000 preference). 51,008 ordinary and 23,997 preference shares taken up. £13,004 paid. £62,001 considered as paid. Mortgages and charges, £6,500.

Suppliers Construction Co., Ltd. (formerly Charing Cross and City Electric Co., Ltd.) (66,081).—Capital, £350,000 in £5 shares. Return dated December 8th, 1921. All shares taken up. £350,000 paid. Mortgages and charges, nil.

Aron Electricity Meter, Ltd.—Capital £350,000 in 125,000 preference and 225,000 ordinary shares of £1 each. Return dated January 2nd, 1922. 124,896 preference and 125,000 ordinary shares taken up. £124,948 10s. paid on the preference, including £32 10s. paid on forfeited shares. 125,000 ordinary shares credited as fully paid. Mortgages and charges, £92,100.

Mexico Electric Tramways, Ltd.—Capital £1,000,000 in 500,000 preference and 500,000 ordinary shares of £1 each. Return dated December 31st, 1921. All shares taken up. £500,000 paid on the preference. £500,000 considered as paid on the ordinary. Mortgages and charges, £721,000.

Nalder Bros. & Thompson, Ltd. (62,214).—Last annual return dated March 16th, 1921, when capital was £25,000 in 12,500 preference and 12,500 ordinary shares of £1 each, of which 11,500 preference and 11,781 ordinary had been issued. £13,281 had been paid on 11,500 preference and 1,781 ordinary, and £10,000 was considered as paid on 10,000 ordinary. Mortgages and charges, nil. In June, 1921, the capital was increased to £30,000 by the creation of 2,500 new preference and 2,500 new ordinary shares. 400 preference and 100 ordinary shares were allotted, payable in cash, on December 12th, 1921.

Morley Electrical Engineering Co, Ltd. (52,358).—Return dated February 22nd, 1922. Capital, £5,000 in £1 shares. All shares taken up. £1,020 paid; £3,980 considered as paid. Mortgages and charges, £3,000.

CITY NOTES.

Newcastle-on-Tyne & District Electric Lighting Co., Ltd.

The annual meeting was held on March 24th. Col. F. R. Simpson, who presided, said the capital expended during the year was £20,895, of which amount £21,353 was for mains to meet the continued increased demand for electrical energy for existing and new consumers. Agreements had been entered into for the supply of current to collieries in the Newburn area, which had necessitated considerable extensions to their mains. These collieries were now connected, and were yielding revenue. In 1914 the company paid in rates £2,064, last year (including the supplementary rates) £5,064, an increase of £3,000, which was equal to a dividend of 1¼ per cent. (less tax) on the ordinary shares. This was an item over which the company had no control, but the limiting of muncipal expenditure was one of the most important questions to be considered at the present time. The total receipts showed a decrease of £16,954. This was accounted for by the coal trade dispute, which lasted three months, and by the serious trade depression which affected power and lighting consumers alike. At the beginning of the strike the company had a large stock of coal, and with the assistance of oil fuel, were able to maintain the supply. For the first two months in 1922 there was an improvement in the figures as compared with those of the latter part of last year. The directors regretted that owing to the present unsettled conditions of trade, they did not feel justified in recommending a higher dividend. A dividend at the rate of 4 per cent., less income tax, was approved.

Hadfields, Ltd.

After paying the dividend announced in our last issue, £122,657 is to be carried forward. The report says that the year was not without serious industrial troubles, and the unfortunate coal miners' dispute, which lasted for thirteen weeks, greatly affected the workings of the company. Owing to the considerable volume of orders in hand at the beginning of the year 1921, the effects of the general depression in the engineering industry were not acutely felt until the latter part of the year. "With regard to this company's interests in the United States, the acute trade depression prevalent there has retarded the Hadfield Penfield Steel Co. in consolidating its various interests and developing the Hadfield system, and it has been necessary for this company to afford some financial support to the American company. There are now signs of an improved demand for the American Company's products, and that the expectations which were formed by your directors in developing this new field will mature. . . . The new steel foundry, which forms an important part of the adaptation of our war extensions to peace purposes, is now completed, and has for some months been working successfully. It will undoubtedly provide a profitable addition to our resources when the general conditions of trade improve. The two smaller rolling mills are also now working successfully, and the large cogging and billeting mill is approaching completion, and will be available for useful service so soon as the opportunity arrives through a revival of trade."

British Insulated and Helsby Cables, Ltd.

In his speech at the annual meeting held on Monday at Liverpool Mr. James Taylor, the chairman, said that the profit was the largest in the history of the company, but in view of prevailing conditions it would be difficult to maintain that high level. Their large capital expenditure in reorganising the works after the war had been fully justified. There was a special demand to-day for high-tension cables, and there was no firm in this country in a better position to supply this demand than this company. While they were the largest manufacturers of high-tension and other cables in the country they had many subsidiary industries, and the latter departments had also been brought up to date. Owing to the facilities which their large capital expenditure in 1920 gave them they had been able during the year to execute the important orders which were on the books at the beginning of the year, and promptly to execute orders subsequently received. The profits were largely due to the improvements carried out in the factory previously referred to; to the completion of old contracts, and to the judicious purchase of raw material. They were one of the comparatively few companies who had not required to increase their capital at a time when the rate of interest was so high, thanks, to a great extent, to the facilities extended by their bankers. The speaker next reviewed the profit and loss account. Later, after alluding to the first-class condition of the works and to the adequacy of the proposed allocation to depreciation, he said that last year, under the heading of stocks and work in progress, they had an increase of £269,000; this year a decrease of £404,000. This was accounted for by the smaller volume of trading at the close of the year, and also by the decline in the value of materials. Sundry debtors were lower by £423,813, which showed a great falling off in trade. Last year they owed the bankers £214,500, but this year they owed them nothing, and had in hand £519,893, which showed a strong cash position, but also the bad state of trade. After mentioning the investments in the Midland Electric Corporation and the Electric Supply Co. of Victoria, Ltd., Mr. Taylor said that they still had a large interest in the Automatic Telephone Manufacturing Co., Ltd., and, in his opinion, that company was steadily strengthening its position.

While it was not proposed to increase the reserve account this year, it was felt that it would be better to increase the carry forward. "We are living in a period of great uncertainty and unrest, whether regarded from the economic, political, or social point of view, and business is affected as a necessary consequence. Orders are scarce, and it is essential to make stronger efforts than ever to obtain them both at home and abroad, not only to enable us to make money, but to provide work for our men. In this struggle to obtain business we have to face keen competition, hence the necessity to consolidate the company's position financially. The opinion of the board is that 1922 will probably be a year of difficulties, not only in our own special trade, but in that of the country generally. They feel that in such circumstances the firm which has ample cash resources is in the best position to face the unknown future, and they therefore propose to carry forward the large sum of £362,223."

British Aluminium Co., Ltd.

The net profits for 1921 amount to £221,507, plus £19,534 brought forward. Provision for income tax, depreciation of investments, and proportion of profits payable to directors requires £37,000; prior lien debenture service fund, £48,000; debenture stock service fund, £43,224; reserve for depreciation, £20,000; carried to reserve account, £10,000. After paying the 6 per cent. preference dividend and 5 per cent. on the ordinary shares (both less tax), £14,791 remains to be carried forward. The depreciation reserve account, including £20,000 applied out of the profits of the year, now stands at £570,000, and the redemption accounts created out of revenue in respect of prior lien debentures and the debenture stock amount to £217,175, making together a total of £787,175. The reserve account, including £10,000 set aside out of the profits of the year, now amounts to £180,000, and is mainly invested in Government securities. Considerable additions at the Alumina Works in Scotland, and at the rolling mills at Milton and Warrington, England, which were commenced in 1920, were practically completed during the year. The whole of the works and plant at the various factories have been well maintained out of revenue. The falling-off in demand, which commenced in the latter half of 1920, continued in increasing scale during the whole of the year under review. The conditions were accentuated by the coal strike, which lasted for a period of 16 weeks, and by the chaotic state of the exchanges with other countries, particularly in Europe. In consequence two of the company's aluminium works and one of its alumina factories were shut down for a considerable part of the year. There are some signs of improvement since the close of the year, but some time must elapse before conditions in the trade become normal. The Lochaber Water Power Bill received the Royal Assent on July 28th, 1921. The powers provide for a large hydro-electric development in Scotland close to the company's existing works at Kinlochleven. Considerable time has been given under the Act before the works need be commenced, and it is not intended to take steps in this direction until the industry shows definite signs of improvement.

Waste Heat and Gas Electrical Generating Stations, Ltd.

The profits earned by the company during the year ended January 31st, 1922, after deducting administration expenses and interest on loans, amount to £35,620, against £34,439 in the previous year; less transferred to reserve, £16,000 (against £14,000). The amount brought forward was £12,603, and the available sum is, therefore, £32,222 (against £38,203). The directors recommend that a dividend be declared at the rate of 6 per cent. for the year, £19,200 (against 8 per cent., £25,600), leaving £13,022 to carry forward. The amount standing to the credit of the reserve account is now £143,851. The redemption funds in respect to plant supplied on hire purchase terms amount to £21,360. Capital expenditure during the year amounted to £20,664, £15,001 of which was in connection with the new power station at Horden. A further amount of £10,000 will probably be required to finally complete this station and the extensions in connection with the gas engine plant at Weardale. To meet the above expenditure it has been necessary to borrow temporarily from the company's bankers, and this arrangement will continue from time to time during the current year. The results of the past year were greatly affected by the miners' strike, the whole of the stations being closed down during the three months from April to June, 1921. The plant at the Horden power station was put into operation again in August, and the Teesbridge and Ayresome power stations started up in September, since when these three stations have been running satisfactorily. It is hoped that the Newport plant will be running again at the end of this month, but the Clarence and Weardale stations are still completely shut down. The aggregate output from all the company's generating stations showed a reduction of 59 per cent. on the previous year.

Clyde Valley Electrical Power Co.

The balance of profit for 1921 was £106,389, plus £69,693 brought forward, making £176,082. The preference dividend for the year (to April, 1922), (6 per cent.), absorbs £18,000. An interim dividend at the rate of 5 per cent. per annum for the half-year on the ordinary shares and a final dividend at the rate of 10 per cent. per annum, makes 7½ per cent. for the year, absorbing £45,000; dividend on the second preference shares for the year (to December, 1921), £4,072; transferred to contingency fund, £50,000; transferred to second preference share special reserve fund, £1,000; writing down cost of second preference share issue, £6,463, carrying forward £51,547. An issue of additional share capital to the amount of £500,000 in 50,000 8 per cent. cumulative second preference shares of £10 each was made in October and is now fully paid up. The 15,000-kW turbo-alternator installed at Clyde's Mill power station was put on commercial load in July. The company's business has been adversely affected during the year by the coal strike, which lasted for three months, and by the general trade depression. The Electricity Commissioners have provisionally delimited the West of Scotland Electricity District, under powers conferred on them by the Electricity (Supply) Act, 1919, and a committee has been formed, representative of all authorised undertakers and other interested bodies within the district, for the purpose of submitting to the Electricity Commissioners a scheme under Section 5 of the Act for improving the existing organisation for the supply of electricity in the district.

Davis and Timmins, Ltd.

Sir Henry C. Mance, C.I.E., presided at annual meeting on March 21st. In his opening remarks he referred briefly to the engineering lock-out, saying that he considered employers were entitled to direct the work in their own factories. He hoped for an early settlement of the dispute. Owing to the fall in prices they had had to write down the value of their stocks, and as they considered themselves entitled to a refund of Excess Profits Duty payments, they had made application to the Inland Revenue authorities. A favourable consideration of this would materially affect next years' balance sheet. The value of investments and the bank balance were satisfactory, and he had no anxiety regarding the future.

Mr. G. E. Davis (managing director) also addressed the meeting, saying that the company had had to contend with high working costs, as well as with the slump and depreciated stocks. The recovery of industry was contingent upon reduced taxation. He regretted the occurrence of the present dispute, as the firm was on good terms with its employés. The employers were not out to smash the trade unions, but were determined to control their own works.

Sir Henry Mance was re-elected chairman of the company.

Austrian Company.

Vereinigte Elektricitäts-Aktiengesellschaft in Wien.—The report read at the 24th ordinary general meeting of the company stated that the difficulties experienced in the past had considerably lightened, but the high price of coal and materials and the increased charges of labour rendered the sale price of electric current inadequate, except in the case of the Czecho-Slovakian works, where the price of current for some time had kept a steady level. Special attention had been devoted by the management to the upkeep of the works, whereby the output had been considerably improved. As the cost for maintenance and renewals was unusually high, single parts in most cases costing more than the whole installation, the writing down reserve had been increased by 3,000,000 kr. which, however, was far below the actual requirements. The political upheaval of the year 1918 had created many hard tasks for firms, and in the altered circumstances they had striven to preserve their property and suit themselves to the new conditions. A number of schemes were under consideration, and one or other would be realised; but it must be borne in mind that they would involve huge building outlays, while existing installations were hard to acquire, holders being loth to part with tangible values. The net profits of the business year, inclusive of the carry forward of last year, totalled 6,337,795 kr., which would be dealt with as follows:—5 per cent. as dividend on the 36,000,000 kr. share capital; 2,100,000 kr. to the reserve fund; of the rest, after the statutory provision for the directorate, 1,800,000 kr. would be distributed as a 5 per cent. super-dividend, the balance of 198,549 kr. being carried forward.

The Philips Lamp Co.—The Amsterdam correspondent of the *Financial Times* states that the Philips Incandescent Lamp shares were firm on the Bourse on several days last week; they improved from 186 per cent. to 210 per cent. on the publication of the report for 1921. "In 1921 the company earned on its increased capital of 10,200,000 fr. ordinary and 4,500,000 fr. preferred shares 6,000,000 fr. net, of which no less than 4,500,000 fr. is set aside for depreciation, the balance being used to pay 11 per cent. on the ordinary and 7 per cent. on the preferred. It is evident from the balance-sheet that the stocks have been written down in a most drastic way, as they figure at only 2,500,000 fr."

Singapore Electric Tramways, Ltd.—The directors state that since the offer from the Municipality of Singapore for the purchase of the company's undertaking was submitted to a meeting of debenture holders on February 17th last, and rejected, negotiations with the Shanghai Electric Construction Co. have been commenced, and are now proceeding. In the event of their being brought to a satisfactory conclusion, meetings of debenture holders and shareholders will be convened to consider resolutions to give effect to an arrangement for the reorganisation and financing of this company. —*Financial Times.*

Llanelly and District Electric Lighting and Traction Co., Ltd.—The annual general meeting was held in London on March 24th, Mr. A. R. Holland presiding. In presenting the report and accounts, the chairman said that in spite of adverse conditions they had been able to maintain the dividend at the same level as that of the two previous years (7 per cent.) and also to put an increased sum to reserve. He referred to the capital issues during the year which had met with success, and stated that the new plant was gradually getting fully loaded.

Shawinigan Water and Power Co.—The report for 1921 shows gross earnings of $4,224,046, against $3,943,559 for previous year, and net revenue $1,590,813, as against $1,609,043. After making usual appropriations and paying dividend on common shares of 7 per cent., there is carried forward $155,406. Owing to the depressed industrial conditions of last year, says the *Financial Times*, the completion of the new power development at Shawinigan Falls will be postponed to September 1st, 1922.

National Electric Supply Co., Ltd.—At the annual meeting, held in Preston on March 16th, the chairman (Mr. John Booth) said that satisfactory terms having been arranged for the acquisition of the Company's undertaking by the Preston Corporation, steps would have to be taken towards the liquidation of the company. Two statutory meetings for this purpose would be held in a few days. The chairman said that the coal strike had had an adverse effect upon the year's results.

German Companies.—The annual report of the Siemens Elektrische Betriebe contains an unpleasant surprise for shareholders, who are informed that the company has been severely hit by the appreciation of foreign, especially Swiss, exchange. The company's debts on this account, the report states, amount to 183,000,000 marks, part of which can be covered from the reserve fund, but there remains an uncovered loss of 162,500,000 marks, which is more than four times the company's capital.—*Reuter* (Berlin).

The Felten und Guilleaume Carlswerk Gesellschaft, of Mulheim and Cologne, has just invited applications for 50,000 ordinary shares of 1,000 marks—representing an increase of capital of no less than 50,000,000 marks—the new shares being offered at a premium of 400 per cent.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

Jutland Telephone Co. (Jydsk Telephon Aktieselskab).—£500,000 5½ per cent. sterling bonds of 1922, issued at 93 per cent., partly paid and fully paid, after issue of allotment letters.

Metropolitan-Vickers Electrical Co.—51,046 ordinary shares of £1 each, fully paid, Nos. 6,270,905 to 6,321,950.

Newmarket Electric Light Co., Ltd.—At the annual meeting on March 20th, Mr. F. E. Gripper (chairman) stated that a gross profit of £3,435 had been made, as against £2,953. After providing for debenture interest and adding balance brought forward there was a balance of £2,974. A dividend of 3 per cent. was declared, £1,750 transferred to reserve, and the balance, £427, carried forward.

Swansea Improvements and Tramways Co., Ltd.—A dividend of 6 per cent. on the ordinary shares for 1921 is to be paid and £3,613 carried forward. New capital expenditure during the year was £15,154, and renewals costing £8,583 were charged to renewals fund.

Tyneside Electrical Development, Co.—The profit for the year ended January 31st was £3,291, plus £1,383 brought forward. £1,100 is placed to reserve. A final dividend of 3 per cent. on the preferred ordinary shares, making 6 per cent. for the year, is recommended, carrying forward £574.

Bideford and District Supply Co., Ltd.—This company, which appeared in the list of "New Companies" in our last issue, has invited offers for the whole of its preference and ordinary share capital. The list was announced to close to-day (Friday).

Reading Electric Supply Co., Ltd.—A dividend of 4 per cent. on the ordinary shares for 1921 is announced. £352 is put to writing down debenture expenses account, £5,500 to depreciation and reserve, and £1,779 is carried forward.

Cia. de Electricidad de la Provincia de Buenos Aires, Ltd.—Holders of coupons No. 21 attached to the company's bonds payable on April 1st, 1922, will receive payment at the rate of 8s. per coupon.

Austin Motor Co., Ltd.—The Press reports that the receiver for the debenture holders was paid off last week and a new scheme under which the business will be carried out by the board came into operation on March 25th.

South Staffordshire Tramways Co., Ltd.—A dividend of 4 per cent. on the preference shares is announced, and £462 is to be carried forward.

Wood & Cairns, Ltd.—We are informed that the company has declared for 1921 dividends of 7½ per cent., less tax, on both the preference and the ordinary shares.

P. & W. Maclellan, Ltd.—Dividend of 8 per cent. on the ordinary shares, carrying forward £27,039.

STOCKS AND SHARES.

TUESDAY EVENING.

WITH the end of the first quarter of the year, there has come the usual tightening process in the Money Market, though this is so seasonable that it has occasioned no change in Stock Exchange prices. In fact, the War Loan has attained a record level, and the strength of gilt-edged securities made further upward progress as the War Loan advanced towards 99. Home Railway stocks have become one of the most active of the markets round the House. Amongst these, Metropolitans are enjoying a considerable amount of popularity. Districts have begun to follow the leadership of "Mets.," while the stocks of the Underground company linger behind the others.

The old rumour has been revived to the effect that the Great Western is angling for purchase of the Metropolitan. As we have observed many times during the last 25 years in this particular column of the ELECTRICAL REVIEW, there is nothing very unlikely in such a project. The Great Western and Metropolitan are closely associated in various suburban services, and, with the present-day tendency towards grouping of companies, the absorption of various Welsh lines by the Great Western is not at all unlikely to be followed by that of the Metropolitan. Consequently, the ordinary stock has gone up to 39½, and the company's prior-charges are also stronger. The 3½ per cent. debenture stock at 70½ and the 3½ per cent. "A" debenture at a point lower are both better than they were a week ago. District 3 per cent. Consolidated Rent-Charge has risen to 55, and the company's guaranteed stock at 69 ex dividend is a point or two harder. Central London 4½ per cent. preference at 67 is better and almost unobtainable. The company ordinary assented stock is 2 higher at 64. City & South London 5 per cent. preferences, of the various four dates, are difficult to obtain at the common-quoted level of about 76½. London Electric 4 per cent. preference moved up to 69, which is ex dividend, and Metropolitan 3½ per cent. preference at 64 is also xd. District 4½ per cent. preference has been changing hands about 58. Underground Electric Railways of London 6 per cent. income debenture has strengthened to 96; the other issues are dull for choice.

Electricity supply shares continue to move upwards. In every week during the past two months there have been rises in the lists of ordinary and preference shares. The improvements, moreover, are held in every case. It is rarely that any of the gains are even relaxed. Preference shares are wanted as well as ordinary, while the debenture stocks have become almost impossible to buy. City of London preference advanced to a guinea, and gains are established this week in Charing Cross ordinary, Chelsea—with a jump of 12s. 6d.—County of London, Kensingtons (7s. 6d. higher), South Londons and Westminsters. Provincial shares are strong, and Yorkshire Electric preference, the price of which opened after allotment at 4s. 9d. premium, are now up to 8s. premium. North Metropolitan preference stiffened to 1¼ premium. Other new issues in this particular market hold their prices without showing marked features. Several companies, according to rumours that do not sound improbable, are likely to ask for fresh capital in the near future.

There must have been a lot of selling orders about in Marconis, to be executed when the price rose to £2. Around the level figure, the quotation hung for several days before it could get away, though once the selling at this price had been cleared off, a further half-crown advance came about promptly. The market has thrown off much of the weakness which oppressed it at the time not long ago when the Italian holders were endeavouring to realise shares, and it now begins to attract a good deal of speculative attention. This interest has started to extend, and Canadians spurted from 6s. 9d. to 8s. 3d. Mariées are a little harder at 26s. 9d.

In the market for Cable stocks the tendency has been a little less firm. Eastern Extensions are ½ lower, and Eastern ordinary lost a point. Indo-Europeans, on the other hand, are £2 up at 37, on the reported quieting-down of the disturbances in the Dependency. Westerns at 18½ are ex the dividend. United River Plates lost 1/16, and a few of the American dollar stocks in this market are better. Telegraph Constructions at 24s. are 5s. down. Henley's, after being 39s., reacted to 37s. 6d., but the preference at 4½ are half-a-crown better. Callenders have risen to 35s. 9d. British Insulated ordinary at £2 a share are another 3s. higher, on the excellent report just out. The figures make a capital showing, and the company may be congratulated upon the way in which it has come through a very difficult year. British Aluminiums fell 1/16 to 13s. 9d., and Edisons 6d., to 3s. 6d. Siemens are unaltered at 25s. Metropolitan-Vickers preference at 2 3/16 are again 1/16 up, in consequence of the dividend announcement on the ordinary shares, to which reference was made here last week. Edmundson's cumulative preference at 3½ have gained five shillings.

Monterey Light & Power new issues have now come to be officially quoted, and stand at 34, 16½ and 4 for the "A," "B" and "C" respectively. Shawinigan at 115½ and Kaministiquia at 86½ are both a point harder. The Mexican market is almost dormant, and the only change this week is a rise of a point in Mexican Light & Power first bonds at 63½. Brazil Tractions at 41, showing a gain of 2, follow the course set by the prices for the country's bonds. Anglo-Argentine Tramways first preference hardened to 3 5/16. City of Buenos Ayres Trams are better at 4 1/6 and, in the home list, Torquay Tramway ordinary shares at 19s. 6d. have risen about 1s. Something of a feature has been furnished this week by a rise to 26s. 3d. in Brush ordinary shares, demand being stimulated by the recent report.

Vickers have been a firm market at 9s. 4½d., and the engineering group as a whole is very firm. Babcocks remain at 2½. Amongst rubber shares, there is nothing doing. The market is once more neglected, and no one seems to take any interest in the share-list.

[As in certain copies of the ELECTRICAL REVIEW for March 24th, some of the figures appearing in the "Gross Revenue" and "Expenses" tables were not very plainly printed, we shall be pleased to send a clear pull to any reader whose copy was not legible if he will drop a line to "The Editors."]

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend. 1920.	Dividend. 1921.	Price Mar. 28, 1922.	Rise or fall.	Yield: p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	12	12	7½	—	£8 6 6
Charing Cross Ordinary	8	9	6¾	+ ½	7 7 0
do. do. do. 4½ Pref.	4½	4½	8¾	—	6 18 4
Chelsea	6	6	8¾	+ ½	6 17 1
City of London	14	14	3⅞/-	—	7 15 7
do. do. 6 per cent. Pref.	6	6	21/-	+1/-	5 14 3
County of London	8	8	11½	+ ½	6 15 6
do. do. 5 per cent. Pref.	6	6	9½xd	—	6 11 6
Kensington Ordinary	9	10	6¾	+ ½	7 17 0
London Electric	2½	4	1¼	+ ½	9 8 4
do. do. 6 per cent. Pref.	6	6	4½	+ ½	7 5 5
Metropolitan	7	7	4¾	+ ½	7 7 4
do. 4½ per cent. Pref.	4½	4½	8¾	—	6 8 7
St. James' and Pall Mall	12	12	7½	—	8 5 6
South London	7	7	8½	+ ½	8 7 0
South Metropolitan Pref.	7	7	1¼	—	6 4 5
Westminster Ordinary	10	10	6¾	+ ½	7 8 2
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	96	—	6 5
do. Def.	1½	1½	21½	—	8 2 0
Chile Telephone	6	6	5¾	—	5 11 7
Cuba Sub. Ord.	7	7	7¾	—	9 0 8
Eastern Extension	10	10	18¾	— ½	5 8 10
Eastern Tel. Ord.	10	10	186½	—1	5 7 8
Globe Tel. and T. Ord.	10	10	18¾	—	5 8 1
do. do. Pref.	6	6	10⅞	—	5 11 7
Great Northern Tel.	22	24	28½	—	8 8 3
Indo-European	10	10	37	+2	6 19 0
Marconi	25	15	2½	+ ⅛	7 1 2
Oriental Telephone Ord.	12	12	2	—	*6 0 0
United R. Plate Tel.	8	8	6⅛	— 1/16	*5 17 5
West India and Panama	Nil	Nil	5/-	—	Nil
Western Telegraph	10	10	18½xd	—	*5 8 1
HOME RAILS.					
Central London Ord. Assented	4	4	64	+2	6 5 0
Metropolitan	1½	1½	39½	+2	5 14 0
do. District	Nil	Nil	29	+2	3 9 0
Underground Electric Ordinary	Nil	Nil	1¼	— ½	Nil
do. do. "A"	Nil	Nil	5/6	—	Nil
do. do. Income	4	2	71½	—	*5 12
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams, First Pref.	5½	12½	3 3/16	+ 1/16	8 6 0
do. do. 2nd Pref.	Nil	6½	3½	—	7 17 2
do. do. 5 per cent. Deb.	5	5	74	—	6 13 4
Brazil Tractions	Nil	Nil	41	+2	Nil
British Columbia Elec. Rly. Pfce.	5	5	64½	—	7 15 6
do. do. Preferred	5	33/-	56½	—	*7 18 0
do. do. Deferred	3	134/-	46½	—	*10 18 0
do. do. Deb.	4½	4½	66¾	—	6 7 9
Mexico Trams. 5 per cent. Bonds	Nil	Nil	28½	—	—
do. do. 6 per cent. Bonds	Nil	Nil	37½	—	Nil
Mexican Light Common	Nil	Nil	16¾	—	Nil
do. Pref.	Nil	Nil	30½	—	Nil
do. 1st Bonds	Nil	5	83½	+1	7 17 6
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	9⅞	—	5 11 4
British Aluminium Ord.	10	10	13/16	— 1/16	—
British Insulated Ord.	15	15	2	+3/-	7 10 0
Callenders	15	15	35/9	+9d.	8 8 0
,, 6½ Pref.	6½	6½	1⅞	—	6 7 4
Crompton Ord.	10	10	15/-	—	13 6 8
Edison-Swan	10	—	3/6	—6d.	—
do. do. 5 per cent. Deb.	5	5	89	—	8 1 4
Electric Construction	10	10	20/9	+9d.	9 12 10
English Electric	8	8	9/9	+3d.	16 8 4
do. Pref.	6	6	16/8	—	7 7 8
Gen. Elec. Pref.	6½	6½	20/9	—	6 5 4
do. Ord.	10	10	21/-	—	9 10 8
Henley	15	15	3¾	—6d.	8 0 0
do. 4½ Pref.	4½	4½	4½	—	5 9 4
India-Rubber	10	—	1½	—	—
Met.-Vickers Pref.	8	8	2 3/16	+ ½	7 6 2
Siemens Ord.	10	10	25/-	—	*8 0 0
Telegraph Con.	20	20	24	— ½	*5 0 0

* Dividends paid free of Income Tax.

ELECTRICAL PROGRESS IN CHILE.

British Participation in Contract Work.

By PERCY F. MARTIN, F.R.G.S.

The number and value of contracts entered into by the Chilean Government with foreign electrical firms has attracted attention to Chile as a favourable field for electrical operation. Hitherto, British enterprise has played a prominent part in its hydro-electrical development; but, of late, competition from both United States and German sources has become additionally keen, with the result that it is now no longer a matter of facility to obtain concessions upon terms anything like as attractive as before the war. Teutonic competition is the more to be feared in view of the superior advantages enjoyed by our German rivals, first, in connection with their persistency in canvassing for orders, in which the heads—and not merely subordinate officials—of active firms engage; secondly, by an improved and extended ocean transport service; and, thirdly, by the prevalent rate of exchange which enables German manufacturers to quote prices very much below those possible for either North-American or European houses.

Chile possesses two kinds of hydrographic basins; the great depressions which extend from the Cordillera de los Andes to the sea, and the lesser hollows which collect the streams from the western watershed from the coastal-range. The sources of most Chilean rivers are found at considerable heights, while their courses are relatively short. They invariably exhibit in their upper and middle parts, and often, indeed, in their lower courses, sharp inclinations which could easily be utilised for the generation of hydro-electric power, and especially for the installation of central electric power-stations for the transmission of mechanical energy over long distances. The network of rivers which covers Chilean territory permits of the utilisation throughout the country, and with comparative facility, of the power permanently developed by these streams.

One river alone may be cited as an instance, namely, the Palena, which flows, at 43° 45 S. latitude, into the south-west of the Corcovado Gulf. Navigable up to its first rapids, a distance of 22 miles, by vessels drawing 9 ft. of water, the river-entrance is obstructed by a bar of shifting sand which leaves a channel varying according to the time of the year and the weather prevailing in the Gulf. Past the bar, depths are found at low tide of 15 to 21 ft., soundings generally giving irregular results. The river, however, always affords a channel of not less than 11 ft. in depth, and, in some parts, a depth of as much as 66 ft. is found. The ebb-tide has a velocity of two to four miles an hour, while often at the first rapids the current is very strong, and at every half-mile there are other rapids.

Other rivers of commercial or industrial importance are the Aysen, the Baker, and Pascua. The first is navigable for 7½ miles, to near the first rapids; the second has a length of 97 miles, and rises in Lakes Buenos Aires and Cochrane; while the third, rising in Lake San Martín, and flowing for 35 miles through a narrow channel, has an abundance of water with a current of great strength. The Lacustrine region likewise exhibits interesting characteristics from the point of view of industry assisted by hydro-electric installations.

One of the most important hydro-electric concerns in Chile, known as the Compañia Nacionál de Fuerza Electrica, in combination with the Chilean Electric Tramways and Light Co., Ltd., has recently got to work. The available capital is £12,000,000 sterling, the greater part of which will be devoted to the development of hydro-electric energy from the mountain streams in the central section of the Republic and the supply of light and power to the capital, Santiago, and the adjacent cities and towns. The new combination will be known as the Compañia Chilena de Electricidád, Limitada, and will control the whole of the street-railway system of the capital and the electric light and power supply of that city, while it will also be in a position to furnish electric energy for the various industries located in the Santiago-Valparaiso district. The company has secured a contract to furnish the current required by the electrification now under way of the first zone of the State railways, which undertaking is in the hands of the Westinghouse Electric International Company, with whom are associated the Chilean agents, Messrs. Errazuriz, Simpson & Co., and Messrs. Spruile, Braden & Co., of New York. The Campañia Chilena de Electricidád possess several power plants, while another hydro-electric station of 50,000 h.p. is about to be constructed by them. The plants now in operation include that of La Florída, located 12 miles from Santiago, with 20,000 h.p., and a steam auxiliary in the capital of 18,000 h.p. (now to be increased to 28,000 h.p.).

At Maitenes, 35 miles from Santiago, on the Rio Colorado, an additional plant is now under construction to supply 35,000 h.p. The capital being expended upon this enterprise, which is almost entirely of Chilean origin, exceeds $3,250,000 (gold). Eighteen thousand h.p. is to be developed at once. This important concession has been granted to a group of British, North-American, and native electrical engineers, which includes Messrs. Percy H. Ipsen; George C. Kenrick, and John Tonkin. The chief engineer is Mr. F. S. Badger, of the firm of Messrs. J. G. White & Co., Ltd., of London and New York, a specialist in hydraulics; while the manager will be Mr. Norman Rowe, who formerly occupied a similar position with the Guanajuato Power and Electric Co., of Guanajuato, Mexico. The former engineer of the same company, Mr. T. K. Matthewson, will occupy a similar position with the Compañia Chilena de Electricidád, Limitada, in conjunction with a number of Chilean engineers of acknowledged ability. It is proposed to exploit a wide district comprised within the area lying between the port of Valparaiso, the capital city of Santiago, and the town of Rancagua, wherein plants are to be erected on the main rivers Colorado and Maipo capable of supplying electric energy to the extent of 90,000 h.p. This power will become available for industry at a price which will compare favourably with that of other countries in which electric energy is derived from natural forces. The obvious uses will probably include the electrification of future as well as of existing railways. Four large electric plants are contemplated in the future; but, for the present, one only, capable of developing 35,000 h.p., will be constructed at Maitenes, where a fall of 183 metres is available, other necessary conditions being equally favourable.

A smaller project for supplying the central railway zone of Chile with electric power has proved eminently successful, and the State railway management has been favoured with a letter of congratulation from the National Society of Chilean Miners. High expectations have been built upon the employment of surplus current in developing several of the mining and industrial enterprises located in this part of the country.

Other Chilean electrical enterprises, either commenced, or about to be commenced, include the extension of the electric lighting service in the town of Quiritue, the original concession for which was granted to Señor José Raurich; an electric tramway service for the port and city of Antofagasta, connecting the principal streets of

the town with the port; the construction of an electric power and lighting works at San Francisco de Limache, the concession for which was granted to Señor Jorge Ariztia; and the installation of an electric plant in the town of Natales, in the Magellan Territory, the concession for which has been granted by the Government to Señor Gregorio Salas.

It has been decided that a considerable portion (over 25 per cent.) of the 144 miles of track comprising the first zone of railways to be electrified in Chile shall be double-tracked. These sections lie between Valparaiso and Limache, a distance of 27 miles; between Ocoa and Llai-Llai, eight miles; and between Yungai and Mapocho station, a distance of 1½ miles, making a total distance of 36½ miles of double line. The track will be 5 ft. 6 in. gauge, laid on Chilean oak sleepers and rock-ballasted practically the entire length of the line, in the first zone; for the section between Llai-Llai and La Cumbre (the Summit) and that between Calerá and Ocoa, the rails will be 85 lb., but for the rest of the line between Valparaiso and Santiago the weight of the rails will be 80 lb., and for the branch to Los Andes, 75 lb.

In Chile, grade conditions have always proved an obstacle in the way of moving trains expeditiously and cheaply. In order to overcome this difficulty in the first zone, it has been necessary to maintain several "helper" sections to handle the freight traffic, while practically all passenger-trains have required "helpers" to ascend the Tabon grade, between Llai-Llai and La Cumbre. With electric operation, "helper" services will be eliminated, except in connection with the freight trains ascending the Tabon grade. Here the maximum ascent is 2.25 per cent., while the Summit has an elevation of 2,600 ft. above the level of the sea. The maximum grade on the eastern slope is 1.81 per cent., and is located north of San Ramón. Santiago, the capital of the Republic, stands at an elevation of 1,800 ft. The change to electric traction will permit of largely increasing the freight tonnage without the necessity of changing the rails, since track stresses will be less even with engines of greater power than those in service at the present time. The facts that greater tonnage per train can be borne, and that for equal tonnage the track maintenance will be less with electric operation than with steam, largely influenced the Chilean Government in its decision to electrify this portion of the State system.

SPAIN ISOLATED: EFFECTS OF NEW TARIFF.

In his report on the industries and commerce of Spain up to December, 1921 (Department of Overseas Trade, 1s. 6d.), Capt. U. de B. Charles, the Commercial Secretary to H.M. Embassy, Madrid, emphasises how, after the cessation of the war boom Spanish producers found themselves once more confronted with the stern realities of competition. Throughout 1921 the inevitable process of normalisation continued, and Capt. Charles adds that, in the case of Spain, it was a painfully depressing process of coming down to earth.

The heavy import tariff, so long threatened and now introduced, arose from the precipitate fall in prices which brought Spanish industry to a gravely necessitous state. If, however, the tariff remains in force, it is the opinion of many, not only outside, but also inside Spain, that the Government at Madrid will be faced with a situation for which the remedy will prove worse than the disease.

Outlook for British Trade.

In Capt. Charles's view, although a high tariff will inevitably reduce imports of manufactured goods to a minimum, and probably keep out luxuries and modern conveniences, a sufficiently large variety of requirements would remain to be imported. In spite of high costs of production, high freights and a high exchange rate, H.M. Commercial Secretary records welcome enterprise on the part of individual British manufacturers in their efforts to meet the Spanish manufacturer half way. This new spirit of flexibility is appreciated by the Spaniard and, Capt. Charles states, will undoubtedly bear fruit when conditions improve. At equal prices British goods are still preferred, owing to their reputation for quality; in fact, within reason they often find a market even at a higher price. It is this element of goodwill that has caused consideration to be given to British offers in many cases where otherwise the price would have immediately ruled them out.

With a new tariff subject for three months after its eventual introduction to modifications by Treaty, it is impossible to forecast the trend of future commerce between Great Britain and Spain with any certainty. Much will depend on the success or failure of the steps taken by His Majesty's Government to prevent the excessively high duties proposed by the Spanish Tariff Commission from being permanently applied to British goods.

Beneath the gloomy surface of things, however, certain basic factors give ground for hope. Spain is manifestly unequal to supplying all her wants in any event. The reputation of British manufactures as the best still subsists. There are signs of improvement in British selling methods—though there is much leeway yet to be made up—and if costs of production continue to moderate and freights become lower there will be every reason to anticipate a re-establishment of trade on a sound footing, provided that the new duties are not out of all proportion to the real interests of Spain herself. Whatever extremes the tariff may reach there will inevitably remain, after Spanish industry has done its utmost, a large unsatisfied demand, and it will behove the British manufacturer to study the market afresh in the light of the new duties, with a view to ascertaining in what ways it may yet be possible to pick up the threads of pre-war business and capture new markets.

Handicaps on Imports.

For a long period high freights contributed to keep down the influx of goods from abroad, but transport ceased to be a determining factor, while Germany, France, Belgium and Italy were more than compensated for this handicap by the depreciation of their exchanges. The situation would have been less acute if any corresponding adjustment had taken place in the conditions of production in Spain. But little or nothing of the kind happened. Just as Spain took a long time to respond to war conditions, so it is taking a long time to re-adapt itself to conditions of peace. A spirit of sacrifice has yet to manifest itself. Labour has indeed moderated some of its demands, but only negatively. The attitude to impending wage reductions is illustrated by a manifesto which the local Miners' Federation issued to its members in November, calling on them to resist the proposed reductions in the mining industry by force. The coal industry, which during the war had expanded to almost double its normal proportions, had been severely hit. Prices reached such heights that cost of production became merely incidental. Throughout 1919 and 1920 these conditions continued. In the year under review the bubble suddenly burst. The collapse of coal prices in Great Britain caused a panic in the Asturias, which was only saved from being more serious still by the British miners' strike. As a result of frantic appeals to the Government, the duties are being raised on imports, while the maximum consumption of Spanish coal has been made compulsory in the Navy, on the railways and in the mines. It remains to be seen to what extent these measures will suffice to meet the crisis. The margin of price and quality in favour of British coal is so great that it seems bound to find its way into the market somehow, even though in reduced quantities.

While various factors contributed to cripple Spanish import trade there has been a marked falling off at the same time in Spanish exports, mainly due to the revival of activity in the countries which had been at war. The British coal dispute not only interrupted Spain's imports of coal, but indirectly, owing to the closing of the blast furnaces in Great Britain, had the effect also of greatly diminishing Spanish exports of iron ore. In no foreign country did the coal mining dispute in Great Britain re-act so exceedingly severely as in Spain.

Competition in Engineering Supplies.

The Commercial Secretary analyses the Spanish import trade returns. Certain of the comments he makes relative to engineering products are of interest in view of the representations which are being made with a view to obtaining a reduction in the import duties.

Machinery.—The statistics of the first three quarters of 1921 indicate that the trade in machinery has been maintained, but it is probable that the final figures for the whole year will show a decrease owing to the rise in duties. A serious alarm was caused among importers by the Royal Decree of June last restricting mines to Spanish sources of supply for all future machinery which they might require.

In fixed steam and gas engines Great Britain has been hard pressed by Germany, and most of the fixed machines over 25,000 kilograms in weight have been supplied by the

latter country. Germany also leads in semi-fixed engines, followed by the U.S.A. and Great Britain.

Cylindrical steam generators (multi-tubular) is one of the few lines in which Great Britain has retained most of the trade.

In telegraphic and telephonic apparatus the leading source of supply is Germany, followed at a respectful distance by Great Britain.

Electric lamps come from Holland, Germany and the U.S.A. in that order, but there is a large production in the country by German, Dutch and French interests. The German increase is notable.

In dynamos, electric motors and switchboards competition for a trade some four times as large as in 1920 has been swamped by Germany, which has supplied nearly half the total imports. France has, nevertheless, increased her trade more than two and a-half times in the lighter weights, while falling back in heavy machines. A substantial increase is apparent in the imports from Great Britain. The U.S.A. hardly maintained her trade in machines under 400 kg., but has gained considerably in machines above that weight.

Hydraulic motors are mainly supplied by Switzerland and Germany.

Great Britain retains the lead in cranes with about half the total trade, but France and the U.S.A. have supplied increasing quantities.

In pumps Great Britain has been overtaken by both the U.S.A. and Germany.

Great Britain also leads in textile machinery, with some 50 per cent., but Germany has gained more ground during the year.

In machine tools Great Britain has fallen behind, though not so much as the U.S.A. More than half this trade is now in the hands of Germany.

Industrial Progress. The report contains some interesting remarks on the progress of engineering production in Spain. It will be recalled that in connection with the big Spanish railway contract an order for wagons was allotted to Spanish firms and one for passenger coaches and luggage vans was divided between Spanish and Belgian companies. A Barcelona works received an order for 50 locomotives, five of which have already been delivered. Their trials are said to have given very good results. Other firms, amongst whom should be mentioned the Sociedad Española de Construcción Babcock y Wilcox, are proposing to extend their operations to the manufacture of locomotives and spare parts. With the heavy increase in Customs duties on imported locomotives and the special Government facilities granted to Spanish firms undertaking this class of manufacture, the output from Spanish shops should show a large increase in the coming year. The new shops of the Sociedad Española de Construcción Naval at Reinosa have now begun to supply special steels, forgings and castings to all the company's works in Spain.

Aluminium kitchen ware is manufactured, but with no great success. The Toledo steel manufacturers have remained abreast of competition. Eibar is a centre of increasing industrial importance, and now manufactures, besides firearms, large quantities of engineers' tools and small agricultural hand implements, which are exported to South America. In Vizcaya and Guipuzcoa small machine tools are now being manufactured with considerable success.

Hydro-Electric Works. During the year under review hydro-electric development has been principally confined to installations of small horse-power, although construction is proceeding on a number of important installations in different parts of the country.

Mention should be made of the new power station erected by the Ebro Co. at Camarassa to the North-west of Barcelona, where the plant, which is one of the largest, if not the largest, in Spain is now in operation, giving 150,000 h.p. to the industry of Cataluña.

The Hidroeléctrica Española, the second most important company in Spain, have nearly completed construction on their station at Dos Aguas, the junction of the rivers Jucar and Gabriel, to the south-west of Valencia. This station will give some 100,000 h.p. when completed, and will no doubt help to improve the inadequate power and light service of Madrid, where the demands have increased so enormously in the past few years that the existing stations are quite insufficient to meet the requirements. The problem in Madrid is certainly very acute, and it appears within the bounds of possibility that a large steam power station will have to be erected to make Madrid independent of power stoppages due to an inadequate rainfall.

The enormous potential horse-power of the Ebro and Duero rivers is still unharnessed, although it is said that the international difficulties have nearly been overcome and development is now not likely to be long delayed.

INDUSTRIAL ELECTRICAL HEATING.

A lecture on "Industrial Electrical Heating; its present position and future prospects," was delivered to members of the Sheffield Gas Consumers' Association, on March 13th, by Mr. J. G. Pearce, B.Sc. (Eng.), A.M.I.E.E. (Metropolitan-Vickers Electrical Co., Ltd.—Research department). The first part of the lecture reviewed the supply of electricity generally, tracing its progress in lighting and for power, and leading up to the growth of its employment as a heating agent. The speaker gave a number of examples of the use of electrical heating on a large scale for industrial purposes, and said that only the surface of an immense field had been touched. The part of the paper of greater interest to our readers was that giving many details of furnaces at present in use, as well as of others in course of construction or projected. Dealing with industrial electric heating in the United Stafes, Mr. Pearce said that in the latest type of resistance furnace employed the resister was actually put inside the furnace so that it radiated heat directly to the material to be heated . A small muffle furnace of the type made by the Westinghouse Co. had a loading of 6.8 kW and reached 2,000 deg. F. in 75 minutes; 50 steps of temperature control could be obtained between 500 deg. F. and 2,000 deg F. During the war very considerable strides were made in America in the application of wire-wound furnaces, and the largest types were used for heat-treating gun forgings. These large furnaces used nichrome ribbon in sections up to 2 in. wide by ¼ in. thick in loops supported by refractory insulating members projecting from the wall of the furnace. The walls of such a furnace might be 4 in. thickness of refractory and 9 in. of heat-insulation. In one such equipment there were four furnaces and a quenching tank. The furnace was 24 ft. high and 6 ft. in diameter inside. The rating was 400 kW at 440 volts, 60 cycles, a.c. It was found that 12 three-inch tubes (22,300 lb) took 1,880 kWh, and three four-inch water jackets (1,1700 lb.) took 2,088 kWh. The weight per kW-hour was 11.25 lb., making 200 kW-hours per ton, *i.e.*, at the price of Sheffield power, about 20s. per ton. The operating cost in the United States was 12s. per ton. The gas advocates said it needed 8,000 cu. ft. per ton to harden or anneal steel and 4,500 cu. ft. to temper and normalise it. At the most favourable Sheffield rates this would cost 30s. and 16s. 6d. per ton respectively. A Coventry firm found that it would pay to melt brass electrically at 2d. per kWh. It would cost 33s. per ton in Sheffield by gas, or about 15s. 6d. by electricity in Sheffield. With ordnance, of course, cost was not a major consideration, especially if the risks of distortion and cracking with other methods of heating were considered. The time taken to heat was from 5½ to 6 hours. The radiation loss was 70 kW, 75 kW being predicted by the designer. The steel was hardened at 1,450 deg. F., and tempered at 1,150 deg. F. The pyrometer was sensitive to + or − ½ of 1 per cent. of the range. Of these furnaces 22, aggregating 70,000 kW were built during the war, the largest being 8 ft. by 35 ft., internal dimensions, rating 700 kW, and yet this was only half the total of resistance furnaces at present installed. A furnace was under construction of 10 ft. 6 in. diameter, 105 ft. high, taking 2,850 kW, and 320,000 lb. of steel. The resisters were found dependable and permanent, having a life of about two years. Joints were welded when required. The furnace was fitted with several zones, each independently controlled for temperature. The temperature control was effected by having two thermo-couples in each zone, one near the charge and one near the resister. When the charge was put in the couple recorded a fall, and the absorption was so rapid that the temperature fell, but recovered ultimately the temperature curves advanced and approached each other. In this case the difference between the two due to radiation was 50 deg. F.

Mr. Pearce showed by means of a slide an annular ring furnace used for carburising and annealing motor parts. The outside overall diameter was 19 ft., height 7 ft., hearth diameter 15 ft. outside and 5 ft. inside, making the annular ring of the furnace 5 ft. wide. The heating chamber itself was 2 ft. high. The rating was 270 kW at 440-V, three-phase, 60 cycles. The main heating zone was at 1,580 deg. F., and there was a soaking zone at 1,525 deg. F., temperature being automatically controlled and recorded. This furnace took 170 kWh per ton of steel, *i.e.*, about 17s. per ton, at the Sheffield price of 1.2d. per kWh. The charge was 3,000 lb., and the hearth revolved at six speeds, from 30 to 75 minutes per revolution. When shut off at night, it would anneal a furnace full of iron and steel castings before the morning—when it reached 1,000 deg. F. In 40 minutes after starting it was back at 1,525 deg. F. for hardening. The advantages found from experience were as follows:—No distortion of long parts, due to uniform heat absorption; temperature, and time, and rate of heating were under absolute control; scaling was eliminated and only a flash pickle was required on annealed material instead of 3 to 4 hours on annealed material; physical properties were more uniform; handling labour was halved; there

were no rejections for faulty heat treatment; and hardening was made mechanical.

Turning to English-made furnaces, the speaker dealt with the Wild-Barfield radiation furnace, in which the winding was put round a quartz cylinder. The furnace was combined with an arrangement for automatically determining when to harden. The point above which steel lost its magnetic properties was the quenching point, so that when the steel failed to cause a current to flow in a detector coil round the muffle it was removed and quenched. This furnace took 9.5 kW. 70 lb. of work being produced per hour. At 1.2d. per kWh it cost about £2 a ton to run and turned out about 25 cwt. per 40-hour week. It was claimed that a gas furnace cost £7 7s. per ton to treat hacksaws; this was reduced to £2 11s. per ton with this furnace. The Morgan Crucible Co. had developed a crucible furnace in two sizes of 20 lb. and 200 lb., the heat being generated by current which actually passed through the crucible. These sizes took 15 and 30 kVA respectively. In the 200-lb. size, to melt 100 lb. took 27 to 35 kWh. when cold—time 2 to 2½ hours, and 17 to 24 kWh, when hot—time 1 to 1½ hours.

The Leeds Electrical Construction Co. had developed several ingenious appliances for electrical heating. One of the most interesting applications was for rivet heating, and electrical heaters for rivets could be taken to situations were other forms of heater were impossible. In America a special type had been developed in which the rivet completed a circuit. One American firm using 55 rivet heaters in one department found the electrical cost to be 1s. 8d. per 100 lb. of rivets. Oil heating cost 8s. 6d. per 100 lb. The consumption was 14 kWh per 100 lb. The same firm had an automatic plant for hardening and tempering steel strip. Alternating current was actually passed through the strip and the temperature could be adjusted within fine limits. Heating was done in a neutral atmosphere and no scale was produced. The strip was treated in a chamber of phosphor bronze castings lined with refractory, and an oil trough was used for quenching. After this the strip was reheated and quenched for tempering and wound on revolving drums. The cost was stated to be one-half the cost of gas if the basic figures were 2d. per kWh and 4s. per 1,000 cu. ft. Progress on these lines had also been made in the United States, and in many cases material of uniform cross section was heated by direct resistance or induction (*e.g.*, thinwalled nickel-steel tubes). Furnaces working on the resister principle, but using non-metallic resisters, had been employed for many years. Among recent developments a small furnace built up of carbon rings and made by the N.P.L. was of interest. It was very successful, but as yet only used for small furnaces. The Baily furnace, using a granular carbon resistor, was also very successful on a commercial scale. It took time to heat up and was relatively less efficient than other furnaces, but it was certain in operation and gave no electrode troubles. Soaking pits for hot stripped ingots had also been made by Mr. Baily, and reheating furnaces for hot blooms and billets. The present unsatisfactory features of soaking pits which caused lack of uniformity in ingot temperature, excessive oxidation, and high labour charges had led to the electrical pit. It cost in one installation 11d. per ton to keep ingots hot at 2,100 deg. F., 1s. 6d. per ton to boost ingots at 1,800 deg. F., and 2s. 1d. per ton to boost ingots at 1,500 deg. F. to 2,100 deg. F. It was suggested that steel rails could be treated for 25s. per ton with power at 1d. per kWh, with remarkable consequences in improved physical properties.

These applications were all in the iron and steel industries, but recent developments had included heaters for the production of synthetic nitrogen, in which 40 kW of power was dissipated in a space 2 ft. long and 1 ft. in diameter, annealing ovens for the tin-plate industry, and all sorts of furnaces for glass annealing and melting. The economy obtained in repair work by electric welding was extraordinary. Damage to a German ship estimated to cost £8,000 and twelve months to replace had been repaired for £500 in 52 hours.

It would be agreed that the potentialities of electrical energy as a heating agent had scarcely been touched. The conversion of the heat energy of coal to electricity was really an advantage because it enabled us to take anywhere we liked just the heat needed without waste, and it had a series of incidental advantages possessed by no other fuel.

Electricity Supply Costs.—In *The Cost Accountant* (the official journal of the Institute of Cost and Works Accountants) Mr. C. W. Charlesworth, of Wolverhampton Corporation Electricity Department, is publishing a serial article on "Electricity Supply, with special reference to the Cost of Production of Electrical Energy." Mr. Charlesworth, whose exhaustive paper at the I.M.E.A. Conference last year was regarded as an important contribution to the literature of electricity supply administration, deals with the subject very fully, showing how sound methods of costing can be applied to the industry, and giving numerous examples of suitable forms, time sheets, stores warrants, accounts, &c., in full detail. The article will be found interesting and useful to managers and accountants engaged in electricity supply.

CO-OPERATIVE ELECTRICAL PUBLICITY.

Discussion at Bristol.

At the first informal meeting of the members of the Western Centre of the Institution of Electrical Engineers, at Bristol, Mr. J. W. Beauchamp, director and secretary of the B.E.D.A., lectured, with the aid of lantern slides, on the subject of "The Work of the British Electrical Development Association, and upon Advertising in Connection with Engineering and Electricity Development Generally."

The speaker said that there was a tendency for the general form of advertising to increase, its object being to enhance the prestige of the industry represented, to stimulate public interest in its products and to make people more receptive of the particular advertising carried out by individual undertakings supporting it. If properly carried out, such work added definitely to the return secured by the ordinary advertising or selling activities of the individual firms represented. Perhaps the earliest notable example of this class of work was to be found in the operations of the British Commercial Gas Association, now established for many years under the most able direction and supported, it was said, by 85 per cent. of the gas undertakings of the country, who contributed to its funds on a scale considerably higher than that called for by the E.D.A. Electrical development in co-operative form had been in progress in America for some years—there were in that country two associations:—The National Electric Light Association—to a great extent representing the supply undertakings; and the American Society for Electrical Development—largely supported by the manufacturers and contractor dealers. The E.D.A. was in touch with these bodies, and interchanged literature and communications with them. The advertising work of the London traffic combine and the L.C.C. Tramways, might almost be said to fall in the same category, and although in each case carried out for the benefit of a single organisation it was intended to stimulate the travelling habit.

Joint "demand-building" campaigns of this sort had also been carried out more or less thoroughly in other industries. It was difficult to conceive any public service which lent itself better to propaganda of this class than the electrical industry. Such associated efforts soon revealed many difficulties internal to the industry and afforded a means of discussing and removing them, and the maintenance of a united front against attack by competitors, and also a means of removing misunderstandings from the public mind. In short, such work was educative and could be made of a really elevating character if carried out on behalf of something really useful and kept free from exaggeration.

The success of advertising, particularly advertising which was unassociated with any particular name, depended very much upon the nature of the subject. In this respect we were fortunate, electricity always had a Press of its own; it appealed to the popular imagination and it was very easy to do the advertising work in such a manner that it became educative and attractive.

Where a suitable trade name could be invented in connection with an article, it was frequently well worth while to spend a great deal on emphasising the trade name, rather with the view of inducing the public to use the name as a part of the language, than with reference to a particular firm. In the minds of many people any small camera is a "Kodak," and already ladies began to talk about and ask for "Hoovers" when they meant suction cleaners, by which term they did not know them. At the present time, although both supply undertakings and contractors were doing more advertising than formerly, it was principally carried out by the manufacturers, each pushing his own goods and name, but the success of all sections was founded on the growth in the public demand for the electric method.

Costly advertisements circulating over wide areas, could only be immediately effective in those parts where their appeal was supported by reasonable charges for electricity, the presence of adequate distribution systems, facilities for wiring, &c., and for some classes of apparatus, also by hiring systems, showrooms and a general disposition to take load-building seriously and provide an all-round public service of electricity.

The internal work of the E.D.A. tended to remove restrictions and bring about more intensive local support to these advertising campaigns.

Turning to the position of the E.D.A., Mr. Beauchamp said that in January its membership consisted of about 550 contributors amongst supply undertakings, both company and municipal, the manufacturers and the contractors. The Council of the Association was very representative and has been formed by election of a certain number of members on behalf of each of the sectional associations. On the sub-committees there were a good many co-opted persons selected on account of their interest in specific problems which came before the Association from time to time. Municipal supply undertakings were able to become members and contribute to the funds of the Association under Section 30 of the Electricity Supply Act, 1919, and generally the Electricity Commissioners were very helpful and sympathetic. Manufacturers and contractors paid a fixed sum per annum, supplementary

to which, many had given special contributions towards the work. There was no doubt that the work done so far had conferred a considerable amount of benefit on those who had not joined the Association—a state of affairs which only needed to be explained in order to be remedied.

The Domestic Committee was interested in any problems relating to electricity in the home, and domestic load building; it had collected much information on heating, cooking, &c., which was at the disposal of members.

The Tariff Committee existed for the consideration of any matters connected with rates and charges for supply and was in close touch with the Commissioners with regard to methods of charging and the prospect of generalising multipart systems and supporting them by suitable legislation. "Publicity" matter could be had on application, and material for editorial articles on electricity and its uses was sent out from the E.D.A. offices, and given to writers of articles and books. The Council was anxious for the series of salesmanship conferences, running in London at present, to be taken up by provincial Centres. The E.D.A. was associated with a number of other bodies interested in housing, smoke abatement, health, &c., and was represented on various committees dealing with such subjects as wiring rules, unemployment, certification of contractors, electric vehicles, &c.

Mr. Beauchamp then outlined the policy of the E.D.A., and said that often statements and facts were presented in a way which engineers might think undesirably elementary or even childish, but these messages had to be very brief, in the simplest language, and designed to attract and rivet attention by means of slogans or happy turns of phrase.

His committee was strongly of the opinion that something more should be done by all sections of the industry to take the public into their confidence, to let the public know, in simple terms, a little more about the problems and difficulties of the supplier, contractor, and the maker of electrical materials, to let them understand how the ultimate service of electricity depends upon the happy joint working of those three sections, and to bring about amongst everyone in the industry a fuller realisation of the fact that the consumer does not buy electricity or electrical material because that is particularly what he wants, but that he buys and uses the combination of electrical energy and electrical appliances in order that he may secure in a form most convenient and economical to him the actual light, heat, or power which he is really needing.

In the ensuing discussion, Mr. Walker said that he considered that nothing could beat the personal canvasser. The propaganda work which was being carried out by the Association would assist the contractor, the dealer, in fact everybody connected with electricity. He would like to know something more of the film which the E.D.A. proposed screening. The research department of the Association should prove of immense value to the industry. Electric cookers wanted working out on new lines, they were at present too much like gas cookers.

Mr. Roberts thought there was one problem which the E.D.A. could tackle right away, and that was to appoint a committee to trace the origin of unknown fires. Almost every fire the origin of which was obscure was attributed to the fusing of an electric wire.

Mr. F. W. Prosser (sales manager, Bristol Electricity Department) said it was necessary that an active local campaign should be carried on simultaneously and the various inquiries followed up to the fullest extent. He was very interested in the conferences on salesmanship, and he would be glad to hear that similar conferences could be arranged in provincial centres.

Mr. F. L. Thomas (installations engineer, Bristol Electricity Department) thought there was a lot of room for education as far as consumers and users of electricity were concerned. There existed gross ignorance as to the functions of the various apparatus placed on consumers' premises.

Mr. A. J. Newman (deputy engineer, Bristol) said that the address he had the pleasure of hearing dealt chiefly with the ways and means of increasing output, but he supposed the E.D.A. also provided engineers with data relating to diversity and load factors so as to enable them to fix their charges for various classes of supply. Some information upon the subject would be of great assistance.

Mr. T. Hood (Messrs. T. Hood & Co.) said that the contractors, as a body, had a big grievance against rings—unless they were polite and looked after the business and signed this and that they were shut off altogether. The prices as agreed by the various manufacturers were those which were current in the least efficient of that particular group.

Mr. C. T. Allan (South Wales Power Co., Ltd.) said that they had no difficulty in disposing of flat irons and hot-plates and there was a big field for washing machines. Electric cookers were too big, as most of the miners were supplied with free coal. He considered that pamphlets and posters printed in Welsh would be a great advantage.

Mr. A. C. McWhirter considered that co-operation should be carried out to the fullest degree between the manufacturer, the factor, and the contractor, with the supply authority. They should all meet together and discuss the question of pushing electric sales on the lines Mr. Beauchamp had shown them. Salesmanship could be discussed at these meetings and young men encouraged to attend.

Mr. J. W. Beauchamp, in the course of his reply, stated that personal canvassing was very important, but trained canvassers would have to be paid a decent wage. Useful work for women could be found in this direction. Cooks had been brought up to adjustable dampers and they treated electric cookers in precisely the same way as they would a coal fire—they had to be taught the switching habit. He was glad to hear Mr. Prosser's remarks, and if he cared to go further with the matter he (Mr. Beauchamp) would be only too pleased to render him assistance in arranging a salesmanship conference in Bristol. Local newspapers were very good mediums for advertising, but the advertisements must be drawn carefully and cleverly. Then there were local showrooms and exhibitions, but it was necessary to make a local study of the problem. There was little information so far as regarded diversity and load factors, although some information had been obtained from America and a few places in England. Mr. Hood raised a very delicate topic. The question of ring discounts was very vexed and an informal conference tactfully arranged might lead to some solution.

AN UNDERGROUND E.H.P. CABLE.

The British Insulated & Helsby Cables, Ltd., has sent us some particulars of work recently carried out for the North Metropolitan Electric Supply Co., Ltd. The work consisted of the laying and jointing of 6¼ miles of .05 sq. in., 3-core single-wire armoured 20,000-V cable, and the same length of combined screened pilot and telephone cable, both laid in the same trench. The feeder will be protected by means of the "Merz-Beard" protective system.

The route is from the Supply Company's power station at Hertford to a new sub-station at Welwyn Garden City, and

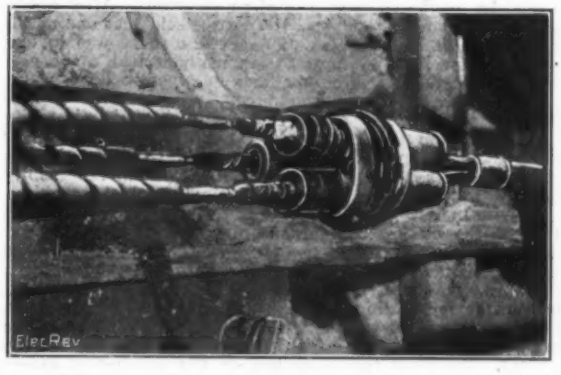


Fig. 1.—E.H.P. Joint.

the cable forms part of an inter-connector between Hertford and the North Metropolitan Co.'s generating station at St. Albans. Both cables were laid direct in the ground with a protective covering of creosoted boards. The normal depth of trench gave 24 in. of cover throughout. One mile of the route lies alongside the G.N. Railway Co.'s branch line to

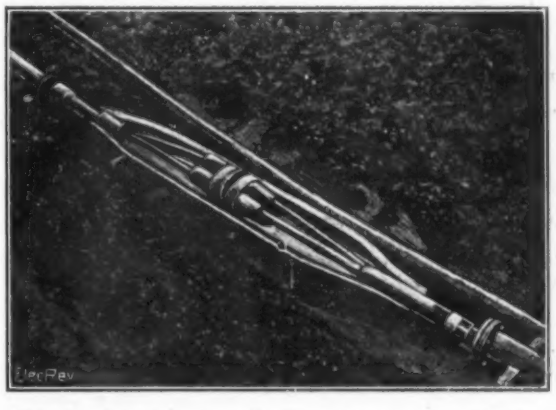


Fig. 2.—E.H.P. Joint, with bottom half of Lead Sleeve.

Hertford, and includes three river crossings, for which special girders had to be provided. The remainder of the route follows the Hertford-Welwyn road, and thence across arable land to the sub-station. The whole work took exactly nine weeks, and the average number of men in all gangs was 60 and the maximum 79.

"Vernier" copper braid and patent baffle plates were

used in jointing, the joints being protected by creosoted boxes with sheet-iron tops.

The cable was tested for 15 minutes by means of a Delon unidirectional testing set with 80,000 V between cores and 60,000 V between cores and earth. The illustrations (figs. 1 and 2) show the jointing arrangements.

THE UTILISATION OF WASTE HEAT FROM POWER STATIONS.

The papers upon the use of exhaust steam and waste heat from generating stations by Messrs. C. Ingham Haden and F. H. Whysall (abstracted in our issue of January 27th, p. 139) were read at a meeting of the North-Western Centre of the Institution of Electrical Engineers in Manchester on February 21st.

In the ensuing discussion Mr. S. L. Pearce said that there was a good theoretical case for the use of waste heat, but the theoretically-perfect and the commercially-practicable were rarely attained together. He questioned the accuracy of the conversion-efficiency figures for gas and electricity works. The efficiency of gasworks was probably more like 37 per cent. The ratio of 14.56 per cent. for electrical stations was no doubt correct for the older stations. There was every reason to hope for 20 per cent. in the future; one station was aiming at, and expecting to get, 25 per cent. At the same time, what was really required was a comparison of *utilised* heat units; he thought that there was no difficulty in proving that to give a definite amount of heat to the consumer involved a smaller destruction of coal at a modern electricity works than at a modern gasworks. After querying one or two other figures, Mr. Pearce said that one of the first difficulties in the utilisation of waste heat was to find a market for it; then transmission methods had to be considered. There were three methods in general: First, steam might be drawn off through a condensing turbine or condensing engine after partial expansion—in this electricity supply was the primary object. Secondly, separate boiler plant could be put down, together with non-condensing generating sets, to deal with the heating load in the vicinity of the station—this would make heating the primary object. The third method was to supply live steam direct. The position of the station in relation to the heating load would determine the use of a particular method. A further problem was the difficulty of co-ordinating the heating and lighting loads; many suggestions, such as "thermal storage," had been made for dealing with this. In Manchester live steam had to be used at times. He considered that Mr. Haden's curves presented the case for steam heating in too favourable a light. Emphasis should be laid on the commercial aspect of the problem. Mr. Pearce gave some figures which indicated the high cost of subways and ducts. He did not think they would ever obtain sufficient revenue to cover the cost of supplying steam.

Mr. J. Frith advocated unbiased consideration of the two services—electricity and heating. The interests should be combined to benefit the community as a whole. He maintained that the demands for electricity and heat in factories were of the same order of magnitude. It was the latent heat in the steam which should be used. This would best be obtained by running the station on low vacuum with calorifiers taking the place of condensers. The vacuum on the steam side of the calorifier would be under the control of the station and varied according to needs. With regard to transmission, new towns should be laid out to allow of this.

Mr. F. Biggin said that the heat losses in transmission were small. The objection to increased boiler power could be met with the argument that this was balanced by the elimination of numerous small and wasteful boiler plants elsewhere. He quoted the example of a combined lighting, power and heating installation which was saving £7,000 a year by the use of a single heating system supplied from the station, instead of a number of small systems.

Mr. D. Brownlie said that although converting a station from condensing to "pass out" would mean a large drop in power it would pay the country to install more plant and sell the heat. Transmission losses only amounted to about .04 lb. of steam per square foot of surface per hour.

Mr. H. C. Lamb put forward some illustrations to show that it was impossible to balance electrical and heating loads, even in such a favourable district as Manchester.

Mr. Nelson Haden wished to see co-operation between gas and electricity works and other public services, which would lead to a more satisfactory position as regarded heating. He mentioned that 336 towns in the United States had central heating stations; most of them were supplied with high-pressure steam, and the stations were under the control of and worked in conjunction with the electrical stations.

Mr. A. B. Mallinson said that not only the load factor, but also the pressure factor had to be considered. The pressure could be standardised for supplying dwellings, but manufacturing processes required varying pressures. He spoke of the encouragement which would be given to manufacturers to put down mills near a works from which they could obtain both power and heat.

Mr. W. Eccles and Mr. Stubbs also spoke.

Mr. C. I. Haden, in reply, said that many electrical engineers would be converted to the idea of the combined heating and generating plant if they investigated the subject.

Mr. Whysall said that it did not pay the users of low-pressure steam to install reducing-pressure plant unless they could sell their surplus electrical energy. He advocated co-operation between manufacturers and supply authorities for this purpose.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Dinner at North-Western Local Centre.

The annual dinner of the North-Western Centre was held at the Midland Hotel, Manchester, on March 24th. Ald. W. Walker (chairman of the Centre) presided, and amongst the chief guests were the President of the Institution (Mr. J. S. Highfield)) and representatives of the electricity supply industry, educational institutions, the municipality, &c.

The loyal toasts having been duly honoured, Mr. W. Clare Lees proposed "The Institution of Electrical Engineers," and, in doing so, thought he was not exaggerating when he said that the I.E.E., with its membership of 10,000, was the largest institution of its kind in the world. An institution that could survive fifty years and keep on growing must be fulfilling some important function, and it was a matter to be proud of that Manchester was the centre of its work. He thought that if some of their old members, like Siemens and Kelvin, could be brought back and see the immense work the Institution had done they would say that the task they had started had been worthily maintained. On behalf of Manchester he was heartily glad to welcome Mr. J. S. Highfield, president of the Institution.

Mr. Highfield responded to the toast. The Institution, he said, for many years now had been trying to keep in touch with the commerce of the country, as well as with science. Without trade the work of engineering and of all science would be as nothing. He was glad to be able to inform them that the last stage in the Royal Charter had been completed, and the new by-laws had been unanimously approved at a meeting held the previous evening. The Council owed a great deal to the members of the local Centres for assistance in framing useful by-laws. They were going through hard times in the engineering trade, but electricity supply was the foundation of the whole engineering business. So long as supply flourished all other branches of electrical engineering would flourish. He understood that when suggestions were made in South-East Lancashire for improving electricity supply by setting up what he would call a Gilbertian body, consisting of all sorts of people elected by other bodies, responsible neither to ratepayers nor to shareholders, they said "No." He thought they were right; in fact he knew they were right. Electrical engineering carried a great many other trades on its back, and he hoped, therefore, that they would go forward and gather strength in good comradeship.

The Chairman proposed "Our Guests," who, he said, were the leaders of men, organisers and captains of the community in that area. He was sorry that the Lord Mayor could not be present, because it was forty years since they had had an engineer as lord mayor. He hoped if would not be forty years before they had another. With the number of technical organisations in Manchester it was becoming increasingly difficult to give attention to the work of each of them. He thought, therefore, that it would be advisable if the older societies got together to see if a proportion of the meetings could not be joint meetings. That evening they met under the shadow of a cloud—he referred to the engineering crisis, into which he was afraid there was a tendency for other societies and bodies of men to be drawn. From his knowledge of both sides of the dispute he believed that the trouble arose very largely from a misunderstanding of the true facts of the case. There was no doubt that a large number of men believed that a deliberate attempt was being made to injure the trade unions, but he could say that such was not the case. He hoped that suspicion would be soon dispelled, and that both sides would soon come together, as ultimately they would have to do.

Dr. H. F. Parshall, in his reply, said it was a pleasure to come to Lancashire because the county got hold of the engineer's end of things. In the south they had engineering adulterated. The engineering intelligence of Lancashire was of the highest order.

After the speeches there was an interval for an informal talk amongst the members, after which a musical programme was rendered.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Simple Magneto Tester.

Having in mind that modern petrol motor cars not only comprise magnetos for ignition work, but also dynamos, motors, batteries, and lamps, quite a number of garage proprietors and motor repair firms are now devoting special attention to electrical repair work, and in some instances simple testing appliances have been devised. The accompanying illustration (fig. 1) depicts the simple magneto testing arrangement which is in use in connection with the repair department of the Eastern Garage Co., 418-418a, Romford Road, Forest Gate, London, E. As will be seen, it comprises a wooden platform, at one end of which is mounted a driving wheel with a handle; at the other end is an adjustable stirrup and clip so arranged as to be adaptable to any make or size of magneto. Secured to the wooden base, behind the clip, are four terminals to which the leads from the magneto distributor can be instantly secured, the terminals being also connected up to leads to which sparking plugs may be attached. Towards the rear edge of the stand is an iron bar twisted to form its own uprights; the bar is provided with

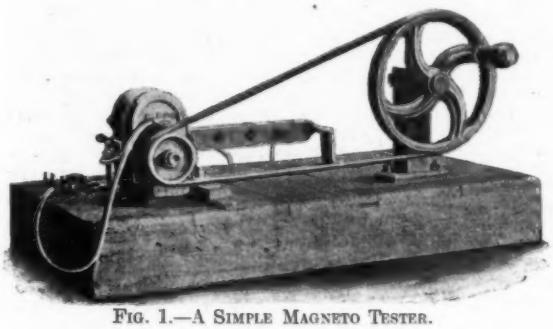


Fig. 1.—A Simple Magneto Tester.

four equi-distant threaded holes to receive the sparking plugs. To test a magneto, it is only necessary to secure it to the stand, slip on the driving band, and turn the handle. As the ratio of the pulleys is about 4 to 1, the machine can be run at a good speed, and its working checked by means of the spark given at the plug terminals.

Large Hand-operated Cable Winches.

The cable winch illustrated in fig. 2 is one of two designed and manufactured by Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, E.C.2, which have recently been shipped to a large firm in India. These winches are being used in connection with the sinking of two mine shafts, where it is necessary to use motor-driven sinking pumps. The feeding cable for the pump motors was also

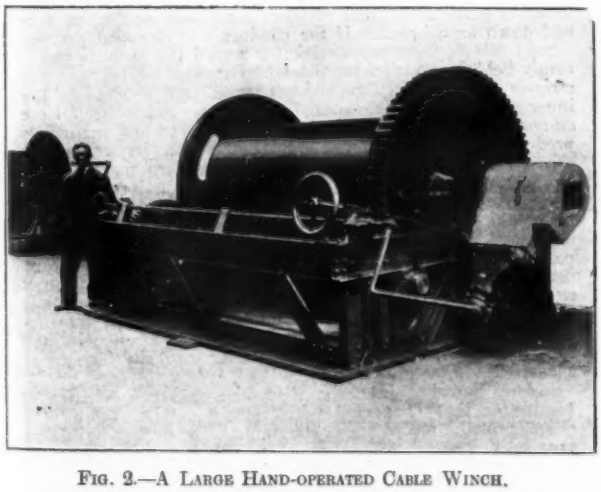


Fig. 2.—A Large Hand-operated Cable Winch.

manufactured by Messrs. Henley's, and each length is 1,014 ft., and weighs 7¼ tons. It is a .75 sq. in., 3-core cable, rubber insulated, armoured with special high tensile steel wire, and jute braided, the overall diameter being 3⅜ in.

It was specified that the winches should be operated by hand, and it was therefore necessary to provide gearing giving a reduction of 524 to 1. This reduction is obtained by means of bevel, worm and spur gearing. The large spur wheel is 6 ft. 1¼ in. diameter, and, as can be seen from the illustration, forms a part of one of the drum flanges. Instead of a shaft, heavy hollow cast-steel trunnions are attached to the sides of the drum. The necks of these trunnions run in cast-iron bearings, which are supported by heavy steel frame work surrounding the drum. To enable the pump motors to be fed while the cable is being lowered, power transmitting gear has been provided, and it will be seen mounted on the right-hand side of the winch. Fig. 3 is a close-up view of this with the cover removed. Three heavy slip rings are mounted on the end of one of the trunnions, and are supported by three insulated studs. Energy is transmitted to the slip rings by means

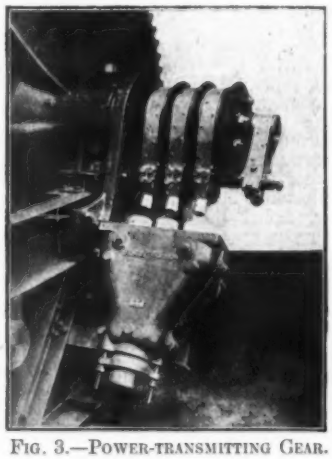


Fig. 3.—Power-transmitting Gear.

of heavy laminated copper bands provided with an adjustable spring tension device. The small slip ring at the extreme end of the gear is connected to the drum and the laminated copper bands to the steel frame work, so that the drum is always earthed. The cores of the cable for feeding the pump motors are permanently attached to the slip rings, and the cable passes along the hollow trunnion and through a hole in the opposite flange. It is then laid in a groove cast in the trunnion casting attached to this flange, and held in position by means of heavy clamps. The cable then passes through another hole in the flange and on to the barrel of the drum.

Artistic Table Lamps.

The possibilities of enhancing the appearance of a room by means of appropriate electric lighting are not fully appreciated, and what should be part of the decoration is sometimes entirely out of harmony. To give its customers a wide choice and enable them to suit their individual needs, the British Thomson-Houston Co., Ltd., 77, Upper Thames Street, E.C.4, has introduced a large selection of table stan-

Fig. 4.—A. B.T.H. Table Standard.

dards carried out in various sizes, designs, and finishes. One of these is illustrated in fig. 4. This is 20¼ in. in height with an amber-glass shade 16½ in. in diameter. It is fitted with two pull-chain switch lampholders and a flexible cord with a combined plug and lampholder adapter. This standard is supplied in one of three finishes, antique bronze, Florentine relief, or dark French brown.

THE FARADAY SOCIETY.

Passivity and Overpotential.

Mr. Ulick R. Evans read a very suggestive paper at the February meeting of the Faraday Society, in which he put forward a new conception of the "protective oxide-film" on metals, which is so often called upon to explain such surface effects on metals as passivity and over-potential. Passivity, it will be remembered, is an inactive state that can be induced in metals such as iron, chromium and others, in which they fail to react with acids or other electrolytic reagents which normally attack them. Over-potential is the depression of the P.D. at a cathodic surface below the equilibrium P.D. before hydrogen is evolved in bubbles.

The usual "oxide-film," in the literal sense, which is called upon to explain passivity or the resistance of highly-oxidisable metals, such as aluminium, to corrosion, is unsatisfactory in that it cannot be detected by ordinary means; in fact the less conspicuous the protective corrosion product the more it seems to protect. Moreover, an oxide-film which is quite efficient in preventing corrosion by a sulphate solution, breaks down entirely in the presence of chlorides. To remove these and similar difficulties Mr. Evans introduces the factor of the relative interfacial tendency of the three substances involved (metal, corroding reagent and corrosion product). The values of these three tensions will determine whether the corrosion product will cling to and protect the metal, or whether it will enter the body of the liquid phase or corroding substance and so fail to protect the metal. An iron anode surrounded by a nitrate solution, free from chlorides, undergoes no visible change when current passes, but becomes passive; a similar anode in a solution containing chloride develops a most visible precipitate of hydroxide, which completely fails to protect the anode. Apparently the protective film in the first case is the compact clinging variety, but in the second case the chloride acts as a partial peptising agent, preventing the oxide from being compact and protective, and pulling it away from the surface. Generally speaking, salts which have a peptising action upon metallic hydroxides may be expected to cause activation, while those which have a flocculating action may be expected to favour passivity.

As to the nature of the oxide-film, this is not to be regarded as a very thin film of the solid oxide. It must be looked upon as a layer of adsorbed oxygen atoms, or discharged anions rich in oxygen, such as would naturally form on the surface of an anodically polarised anode. This layer of oxygen atoms forms a connecting link between the solution, or corroding agent, and the metal. By reducing the discontinuity at the interface it reduces the interfacial energy. Surface concentration of the oxygen atoms is determined by the P.D. existing at the electrode. This conception explains admirably the hindrance caused to the entry of metal into solution, and, substituting hydrogen for oxygen, the cathodic phenomen of overpotential. At the same time, it does not require the invention of hypothetical oxides on anodes or hypothetical hydrides on cathodes, which have previously been postulated to explain these surface phenomena.

The Energy of Gaseous Molecules.

At the same meeting Prof. J. R. Partington considered the question of the internal energy of gaseous molecules from the point of view of present conceptions of atomic structure. Seeing that the monatomic molecules of the five inert gases, of mercury vapour and of desiccated iodine vapour, have identical energies, it is clear that the determining factor must be, not the configuration and structure of the atomic nucleus, but the manner in which the molecule is built up of the nuclei of its constituent atoms and of surrounding electrons, in other words, the internal configuration of the molecule. A difficulty which now arises is to reconcile the modern conception of emission of atomic energy in definite quanta units with the old theory of equipartition, which divided up the translational and rotational energy exchanged by collisions between molecules among their degrees of freedom. Prof. Partington makes the assumption that on the quantum theory the translational energy is represented with a frequency equal to the collision frequency, and on this assumption recalculates the molecular heat of hydrogen and nitrogen. In the discussion the question was raised whether it is legitimate to apply the equipartition theory at all if the quantum conception be adopted.

Fifty Years on the Leeds Tramways.—Mr. William Taylor, of Hunslet, who, at the age of 70, is a timekeeper in the Leeds Corporation Electric Tramways Department, and now completes 50 years' service with the tramways of the city, has been the recipient of a presentation from his fellow employés, and of a gift of £10 by the Tramways Committee. Mr. Taylor began as a driver of horse tramcars and was one of the first of the drivers of electric cars.

REVIEWS.

The Diagnosing of Troubles in Electrical Machines. By Miles Walker, M.A., D.Sc., M.I.E.E., Professor of Electrical Engineering, Manchester University. Pp. xi+450; fig. 332. London: Longmans, Green & Co. Price 32s. net.

The causes of troubles arising in the continuous working of electrical machinery, leading sometimes to failure, are so various and often so unexpected, that at first sight it would seem a hopeless task to make any moderately complete classification, and base on it a guide to remedy. Yet the author has admirably succeeded in this difficult task and has given us a book which will not only be a useful counsellor to the engineer, who may at a moment's notice have to investigate and if possible find a remedy for a mysterious defect, but also to the designer, so that he may avoid hidden dangers quite outside the orthodox theory of design. The book deals to some extent with theory and design, but only in so far as is necessary to make diagnosis clear and remedies understandable; its main object is to help the man who may be classified as a "trouble engineer." A few words of general advice are given him in the preface and may be summarised in a few words: Find out the facts from personal observation, draw your conclusions from these facts and not from other persons' suppositions; make a list of all possible causes of failure that occur to you; take such measurements as this list may suggest; leave the narrow track of preconceived opinion and take a broad view of the case, including all theoretically possible causes of the trouble.

The author distinguishes between "out-door" and "shop" cases. In the former the natural presumption is that the machine has after erection worked satisfactorily until in course of time the trouble has developed. The investigator would therefore be right in confining himself primarily to faulty material, workmanship, or improper use, but not to defects of design. This simplifies his task compared with a "shop" case where design must be included as a possible cause of trouble. On the other hand, an out-door case is often more difficult, because testing appliances may have to be specially procured, and there is not the same freedom in putting the machine into all possible load and running conditions that obtains in the test room of a dynamo works.

In the introductory chapter the reader is given a list of the most important pieces of apparatus which an engineer, suddenly called to some remote site of trouble, should take with him. It is a rather formidable collection of testing appliances.

In classifying the subject matter the author has adopted the plan of first treating troubles which are common to all types of dynamoelectric machinery, and then those which may be met with in some special machines or in some details of machines generally. Thus Chapter I deals with break-down of insulation (30 pages); Chapter II with overheating (27 pages); Chapter III with low efficiency (47 pages). As efficiency is primarily a question of design, this chapter contains a good deal of important theoretical matter, including accurate methods for testing efficiency. The next chapter is headed "Miscellaneous Troubles," such as want of balance, resonance in turbo-shafts, pulling over by magnetic attraction, and a remedy by splitting the winding into symmetrical parts, bearing currents, loose spider, tooth lamination, punchings, and insufficient grip of fingers. A curious case of the perforation of mica tubes is mentioned and explained on p. 149. In spite of the greatest care it might happen that an almost invisibly small iron filing attaches itself to a coil when it is laid down on a bench. If the conductor is stranded and the minute rod of iron embeds itself between the strands and is firmly held in position by the sticky compound between the strands nothing will happen, but if the iron is close to the inner surface of the micanite tube it may work itself loose and under the action of the armature current and main field producing an elliptical rotating field, begin its destructive career of grinding away the mica. In modern machines the strength of this field may reach 1,500 c.g.s. units, but much less suffices to set up the grinding action. The author estimates that a field of 200 c.g.s. units suffices, and quotes an experiment in which a field of 600 c.g.s. units acting on a particle of iron 1 milligram in weight ground a hole 0.2 mm. deep in mica in four hours. Iron adhering to the outside of a micanite tube does not penetrate the material; it simply makes a pockmark because it is pulled to the side of the slot. At the end of this chapter we find a dissertation on noise and how to cure it, which leads the author into the domain of acoustics.

Before entering into the discussion of special cases of trouble or that connected with certain details, there is a chapter on the use of vector diagrams. The author has found that only a small proportion of trouble-engineers make use of vectors when attacking alternating current problems. This seems to be due to want of confidence in the answer given by the diagram, and this again is due to the uncertainty as to the direction in which the vectors shall be drawn. To help the reader to a correct application of vector diagrams to polyphase problems the author gives what he calls "some hints" which he has found useful in his own work, but which in reality is an expansion of the basic principles on which vector diagrams are to be drawn. Beginning with the simple circuit and the correct way of using the two-wattmeter method

on a three-phase circuit he plunges straight away into the intricate problem of obtaining balance in all three phases for a single-phase load by the use of choking coils. The subject is difficult, interesting, and of great commercial importance, because of electric furnaces, but the transition from the simple to the complex problem is too abrupt. It would have been better to pave the way by a gradual development from the simple to the more difficult cases. An engineer who is not well versed with vectors—and it is this person whom the author wishes to help—will not be able to follow him in the equalisation of load in the three circuits, nor in the vector treatment of synchronous machines, which follows.

Chapter VI treats of alternating current generators. Causes of trouble to fail to generate sufficient or any voltage, unsteady voltage, magnetic defects, &c., are investigated. On p. 202 will be found a dissertation on the best way to change a two-phase winding on an old machine to the modern three-phase type. Here the method of moments previously explained is of particular value. This is, strictly speaking, a design question, but discovery of faults and criticism of design are so mixed up that rigid discrimination is not possible. The same holds good for the following paragraphs, such as bad wave form, regulation, sharing of wattless load, parallel operation, phase swinging, flywheel effect, damping, and other matters incidental to the use of synchronous generators.

The regulation of d.c. generators occupies Chapters VII and VIII with 53 pages, whilst sparking at the brushes is considered in the following chapter of 22 pages. Here a great deal of very useful practical information is given. The curves on page 307 showing mean contact drop between positive and negative brush for different current densities with no less than 23 types of brush, will be useful to designers.

In dealing with commutation the author confines himself almost entirely to the modern type of machine with interpoles. The method of analysis beloved by mathematical theorists is not much in evidence, but instead we find an easily understandable treatment based on common-sense mathematics and reinforced by experiment, chiefly with the oscillograph.

We next come to the d.c. motor (shunt compound and series) armature reaction, commutating poles, condition of stability, parallel working, and hunting. In the following chapter we are taken to synchronous converters and here the treatment is very exhaustive. The author leads off with the problem of starting, both from the a.c. and d.c. side; next he considers adjustment of voltage, heating of armature winding, converters in parallel on the same transformer, pulsating of armature current illustrated by oscillograms, the twelve-phase supply obtained from tappings on three transformers, hunting, short-circuit effects, flash-over, and other defects. In the following chapter (XIV) the subject is continued and extended to synchronous motor generators, whilst in Chapter XV. we come to the induction motor. Since the book is intended for professional men the derivation of the circle diagram is not included, but there are some useful hints on defects and their cure; also a clear explanation why even at full synchronous speed the closing of the a.c. switch may be followed by an enormous current rush, which may mechanically damage the motor. The explanation on p. 422 of the crawling of the motor due to the seventh harmonic, and why the fifth has no effect will be useful even to the professional reader.

Transformers, not coming under the title of machines, since this indicates moving things, are not included in the diagnosis, but it is rather surprising that the author is silent on two types of motors which have considerable practical importance. These are the asynchronous-synchronous motor, now extensively used, and the a.c. commutator motor, which is already in use to some extent, and promises to come into more extensive use now that America has shown the way.

The last chapter deals with the oscillograph used in commercial testing, and on p. 430 is shown the apparatus used by the Metropolitan-Vickers Electrical Co., Ltd., arranged as a universal testing set. The oscillograph, with all the auxiliary apparatus is mounted on wheels, and can be brought up to any machine to be diagnosed, so that the discovery of defects is made more easy and certain than would be the case if the apparatus had to be specially procured and assembled in each case.

Since the general plan of the book is to deal with defects more or less common to all machinery first, and then elaborate the diagnosis of special cases, it is unavoidable that back references be made. This the author does by referring to previous illustrations but without giving the pages where they are to be found. It would be a convenience if he were to add this information in a future edition. That a new edition will soon be wanted appears certain. The matter is so good, and the get-up in the way of printing illustrations, and a complex index, so attractive that no manufacturer of dynamo machinery can afford to be without it, and as to the "trouble engineer," he will find it invaluable.

GISBERT KAPP.

The Motor Electrical Manual. Pp. 168, illustrated. London: Temple Press, Ltd. Price 3s. net.

The success or otherwise of this kind of book depends largely on knowing what to leave out. Obviously it is a difficult task to compress into 155 small pages a complete education in the principles of electrical engineering from the commencement, together with practical instructions on the maintenance of all the electric appliances used on modern cars; to be really successful the author must combine complete mastery of his subject together with a very able pen; there is no room for waste of words. In the present case the result is that the information on most points is rather sketchy and incomplete; we never seem to get to the bottom of anything; we read a few lines about some piece of apparatus, and are just getting interested when we are switched off on to something else.

The book is stated in the introduction to be for "motor car owners and users," and therefore we look to find information such as most of these readers desire, that is to say, practical hints on upkeep and management, mentioning the principal types of apparatus in use, so that the reader may learn something about his own car, together with a short and very clear dissertation on the theory of the subject, this theory being confined to a few early chapters, and not confused with the practical portions of the text. In the present volume the theory and the practical information are too much intermixed. For example, the principle of induction should have been thoroughly expounded in the course of the first two chapters, and then left alone, only practical examples of its application being given afterwards. Instead of this the idea of induction is rather vaguely referred to in Chapter 3 on the magneto, is again taken up in Chapter 4 on coil ignition, and once more, in Chapter 6, on the dynamo, a return is made to this elementary theory. Readers of this class of book, moreover do not take the subject very seriously; they like a book which can be read easily without too much "heavy thinking." It is essential, therefore, in order to catch and hold the attention of such readers, that the subject should be dished up in such an attractive form that it tempts their appetite and assists the digestion of the more solid nourishment which is (or should be) concealed within. In the present volume no attempt is made to "gild the philosophic pill," but the facts are presented in a rather dry monotonous procession.

The first two chapters deal with the most elementary facts of electrical knowledge, pressure, current, resistance, magnetic fields, &c. In Chapter 3 a big jump is made to the magneto; it is a far cry from the pith-ball-and-vulcanite-rod type of experiment to the intricacies of the actions and re-actions which occur within the high-tension magneto. A better arrangement would have been to deal first with the induction coil. Short descriptions are given of the various parts of a magneto, timing, relative speeds, &c., followed by the inductor, and one or two other types, concluding with some practical hints on the care of magnetos.

Coil ignition is dealt with in Chapter 4, two good diagrams being given on p. 52, and this is the best chapter in the book, though the statement that spark intensity in coil ignition does not depend on the speed of make and break (p. 56) is misleading. The spark is of greatest intensity at low speeds, and weakens with increase of speed, as mentioned in the same book only a few pages further on.

Chapter 5 deals with sparking plugs in principle and construction. Chapter 6 is entitled "The Dynamo—its Action," a return being made here to elementary theory, as previously mentioned. Descriptions of ordinary, and a few special car types are given so far as this can be accomplished in ten pages. Chapter 7 deals fairly comprehensively with accumulators, while the following chapter treats of lamps and switches.

Chapter 9 is devoted to electric starting, short descriptions of single and combined units being given, with an outline of the Bendix pinion gear and hints on upkeep. A few notes on electric vehicles in Chapter 10 are followed by a slight sketch of the Entz transmission. In Chapter 11 electric auxiliaries are dealt with, including electric welding and X-rays, though the owner or user is not likely to have much to do with the latter operations. A useful glossary of electrical terms is given in the last chapter, followed by notes on materials used in the construction of electrical apparatus, with tables of weights, measures, wire gauge sizes, &c.

There are only a few misprints in the book, but an amusing one occurs at the end of Chapter 5, dealing with plugs. Apparently the word plug has sunk deep into the compositor's brain, for he finishes the chapter with the sentence "when the sparking points are too far away from the main volume of mixture there is a tendency for the ignition and combustion to be pluggish." After all, there is only one letter different in the word sluggish!

An index, interleaved with publisher's advertisements, occurs at the beginning of the book. The author's name is not given, no one apparently being anxious to assume the responsibility of being father to this rather dull little orphan. —F.H.H.

Radium Deposits.—*Science* quotes a report to the effect that Prof. Scouppe, of the University of Ghent, has discovered two radium deposits in the Belgian Congo which are said to be the richest in the world. The mineral, which has been named "curite," is to be treated at Hoboken, near Antwerp, and it is stated that one grain of radium will be produced from ten tons of the mineral.

NEW PATENTS APPLIED FOR, 1922.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,174. "Couplings for machines of high-voltage direct-current series system." C. J. Neth and Soc. Anon. des Ateliers de Sécheron. March 10th. (Germany, April 15th, 1921.)
7,176. "Antenna systems for wireless signalling." Ges. fur Drahtlose Telegraphie. March 10th. (Germany, March 12th, 1921.)
7,197. "Contact legs for thermionic valves." F. W. Pellant. March 11th.
7,210. "Electric horns." I. H. Parsons. March 11th.
7,223. "Head-lamps of motor-vehicles." T. W. Simpson. March 11th.
7,229. "Projection arc lamp." F. T. Ashton. March 11th.
7,240. "Protective devices for direct-current circuits." Electrical Improvements, Ltd., L. C. Grant, and R. W. Gregory. March 11th.
7,252. "Electrical fuses." G. A. Cheetham and Metropolitan-Vickers Electrical Co., Ltd. March 11th.
7,258. "Electric incandescent lamps, &c." General Electric Co., Ltd., and J. J. Gracie. March 11th.
7,260. "Electrical separation of suspended particles from gases." P. C. Rushen (Siemens Schuckertwerke). March 11th.
7,265. "Locking-devices for electric safety lamps." E. Sommerfield (firm of). March 11th. (Germany, March 12th, 1921.)
7,278. "Cascade rotary converters." Forges Ateliers de Constructions Electriques de Jeumont. March 13th. (France, April 5th, 1921.)
7,295. "Electric horns, &c." W. J. Gooderidge. March 13th.
7,297. "Electric cables." F. J. Brislee and British Insulated & Helsby Cables, Ltd. March 13th.
7,317. "Electric switches." A. Howes. March 13th.
7,320. "Electric cut-outs." A. J. D. Krause and A. H. Railing. March 13th.
7,321. "Connector for insulated wires and cables." J. B. Belcher. March 13th.
7,326. "Apparatus for electrical treatment of baldness, &c." M. F. Fisher. March 13th.
7,332. "Automatic, &c., telephone switching systems." H. Baron (F. Aldendorff). March 13th.
7,336. "Methods for determining direction of electro-magnetic or electrostatic fields." N. Lea and Radio Communication Co., Ltd. March 13th.
7,345. "Printing telegraph receiver." Western Electric Co., Ltd. (Western Electric Co., Inc.). March 13th.
7,346. "Uniting metal bodies electrically." P. Buckley and Buckley Saunders & Co., Ltd. March 13th.
7,358. "Thermo-electric fabric and process for manufacture of same." A. Negromanti. March 13th.
7,364. "Appliance for increasing audibility of telephones, gramophones, &c." Baron Clifford of Chudleigh (W. H. Clifford). March 13th.
7,366. "Electric furnaces." E. P. Barfield and L. W. Wild. March 13th.
7,369. "Producing commutator bars." A. O. Hinchliff, S. J. Watson, and Watliff Co. March 13th.
7,371. "Unfusible electro-thermic safety devices." G. Gallo, R. Lenner, and P. Parvopassu. March 13th.
7,378. "Registration of telephone calls." A. Watts. March 13th.
7,399. "Indirect lighting." S. Coxon. March 14th.
7,411. "Portable electric lamps." C. E. P. Gabriel. March 14th.
7,437. "Devices for attachment to mouthpieces of telephone transmitters." M. M. Dessau and Plantation Rubber Manufacturing Co., Ltd. March 14th.
7,446. "Apparatus for testing strength of permanent magnets." A. T. Scorey. March 14th.
7,471. "Electric circuit interrupters." Metropolitan-Vickers Electrical Co., Ltd. March 14th. (United States, March 14th, 1921.)
7,472.—"Electrical insulating cylinders." A. P. M. Fleming and Metropolitan-Vickers Electrical Co., Ltd., and E. S. & W. Whiteley, Ltd. March 14th.
7,476. "Manufacture of electric insulators, &c., from ceramic paste." L. A. Cordenot. March 14th. (France, March 21st, 1921.)
7,483. "Inert cells." Ever Ready Co. (Great Britain), Ltd., and C. S. Mummery. March 14th.
7,484. "Electrically-heated mould for finishing stockings, gloves, &c." F. Schuster. March 14th.
7,494. "Amplifiers." J. M. Miller. March 14th. (United States, March 15th, 1921.)
7,509. "Telephone mouthpiece disinfectant." E. C. R. Marks (W. H. Bennett). March 14th.
7,513. "Electric power accumulator." G. A. Bartholomew. March 14th.
7,532. "Induction motors, &c." T. F. Wall. March 15th.
7,536. "Call recorders for telephones." E. R. Bickley. March 15th.
7,541. "Electric control of a number of telephones." B. J. Baker. March 15th.
7,548. "Accumulator and accessory cases for motor-cycles, &c." R. H. Playfoot. March 15th.
7,621. "Electric cells." Soc. Le Carbone. March 15th. (France, June 3rd, 1921.)
7,622. "Wet electric cells." Soc. Le Carbone. March 15th. (France, December 9th, 1921.)
7,632. "Glass electrodes for high-frequency electric currents." W. H. Gwynn. March 15th.
7,651. "Means for attaching electric wires to sparking plugs." E. Temple. March 16th.
7,674 "Electric lighting systems of motor vehicles, &c." E. W. Reed. March 16th.
7,684. "Electric advertising signs." Implitico, Ltd., and H. S. Lambert and W. R. Lambert. March 16th.
7,708. "Control of turbine-driven electrically-operated winding plant, &c." Metropolitan-Vickers Electrical Co., Ltd., and A. Stubbs. March 16th.
7,734. "Electro-magnetic relay." D. C. Crowe. March 16th.
7,739. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and H. W. Taylor. March 16th.
7,740. "Resilient wheels." British Thomson-Houston Co., Ltd. (General Electric Co.). March 16th.
7,753. "Transformers for wireless circuits." A. P. Welch. March 16th.
7,770. "Electric switch gear of the truck type, &c." W. J. Davis and Park Royal Engineering Works, Ltd. March 16th.
7,771. "Electric switch-point detecting, &c., apparatus." J. Ashton and British Power Railway Signal Co., Ltd. March 16th.
7,774. "Electric cut-outs." A. Baderna. March 16th. (Italy, March 17th, 1921.)
7,775. "Electric cut-outs." A. Baderna. March 16th. (Italy, March 17th, 1921.)
7,776. "Electric cut-outs." A. Baderna. March 16th. (Italy, March 17th, 1921.)
7,785. "Electro-magnetically operated switch mechanism." A. E. Honey and L. Snellgrove. March 17th.
7,814. "Electrically-propelled motor vehicles." C. J. Gordon. March 17th.
7,830. "Electric switch and fuse boxes." F. J. Holton and M. J. Railing and T. Taylor. March 17th.
7,842. "Switching mechanism for telephone, &c., systems." Automatic Telephone Manufacturing Co., Ltd. March 17th. (United States, March 28th, 1921.)
7,846. "Electric contact breakers." A. J. H. Elverson. March 17th.
7,847. "Electric switches." W. Clark. March 17th.
7,852. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. March 17th. (United States, April 26th, 1920.)
7,855. "Electro-magnetically operated switch mechanism." J. Stone and Co., Ltd. March 17th.
7,859. "Electrical signalling systems." Radio Communication Co., Ltd., and J. Scott-Taggart. March 17th.
7,860. "Oscillating valve systems, &c., for wireless telegraphy." Radio Communication Co., Ltd., and J. Scott-Taggart. March 17th.
7,870. "Multiple control apparatus for electric railways." Akt. Ges. Brown Boveri et Cie. March 17th. (Switzerland, March 17th, 1921.)
7,881. "Electrical massage apparatus." T. J. T. Hodgkinson. March 17th.
7,890. "Electro-magnetic locks." V. G. Murray. March 17th. (British India, March 19th, 1921.)
7,893. "Radio-electric relay and electric signalling." J. C. N. Graafland. March 17th. (Holland, September 23rd, 1921.)
7,902. "Self-propelled floating electric power station. F. W. Raisin. March 18th.
7,933. "Portable electric standard lamps." S. J. Levi and H. Rottenburg. March 18th.
7,939. "Manufacture of zinc cylinders for primary batteries." S. O. Cowper Cowles. March 18th.
7,947. "Control of electric motors for traction." T. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. March 18th.
7,969. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., K. R. Hopkirk, and H. W. Taylor. March 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1920.

24,988. "Telephonic instruments." E. W. Pattison (Dictagraph Products Corporation). August 30th, 1920. (176,019.)
25,035. "Storage batteries." D. W. Davis. August 30th, 1920. (176,020.)
27,361. "Dynamo-electric machines." E. A. Watson and M.-L. Magneto Syndicate, Ltd. September 25th, 1920. (176,032.)
27,909. "Electrical switching or circuit-breaking mechanism." Cutter Electrical and Manufacturing Co. October 2nd, 1919. (151,939.)
27,917. "Electrical switching or circuit-breaking mechanism." Cutter Electrical and Manufacturing Co. December 24th, 1919. (155,807.)
28,610. "Magneto electric machines." R. Bosch Akt. Ges. October 24th, 1919. (153,294.)
30,389. "Systems of electric motor control." British Thomson-Houston Co., Ltd. (General Electric Co.). October 27th, 1920. (176,052.)
30,638. "Electric heating and cooking apparatus." B. G. Battson. October 29th, 1920. (176,055.)
30,685. "Suspension chains for electroliers and for like electrical purposes." E. J. Perry. October 30th, 1920. (176,057.)
31,182. "Switching apparatus for automatic and semi-automatic telephone exchange systems." D. L. Lienzen and K. Larsson. November 4th, 1920. (176,065.)
32,395. "Insulated tubes." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 23rd, 1920. (176,074.)
33,319. "Train-lighting and like dynamos." J. Stone & Co., Ltd. (W. Heaton). November 25th, 1920. (176,088.)
33,648. "Electric meters." British Thomson-Houston Co., Ltd. (General Electric Co.). November 29th, 1920. (176,110.)
33,665. "Cooking apparatus for use with gas, liquid fuel, or electricity." Svenska Aktiebolaget Gasaccumulator. December 3rd, 1919. (154,604.)
33,717. "Portable electro-magnetic apparatus for magnetising permanent magnets." A. Hewlett. November 30th, 1920. (176,120.)
33,805. "Electric switches." G. Comboni. November 30th, 1920. (Patent of addition not granted.) (176,123.)
33,832. "Electro-magnetic relays." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). November 30th, 1920. (176,126.)
33,853. "Wireless electrical signalling and apparatus therefor." H. Wade (H. S. Mills). November 30th, 1920. (176,128.)
33,942. "Methods of protecting electric transformers." British Thomson-Houston Co., Ltd., and H. S. Holbrook. December 1st, 1920. (176,134.)
34,041. "Electric relays and their application to telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co.). December 2nd, 1920. (176,143.)
34,218. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.). December 3rd, 1920. (176,147.)
34,543. "Electric light fittings." British Thomson-Houston Co., Ltd. (General Electric Co.). December 7th, 1920. (176,153.)
34,768. "Electric lamp-holders and shade carriers therefor." V. Hope. December 9th, 1920. (176,159.)
35,152. "Coin-actuated signalling apparatus for telephone systems." P. G. T. de Villiers and A. Rogers Jenkins. April 27th, 1920. (162,639.)
35,446. "Electrical apparatus for protection against burglary and the like." E. H. Bock. December 16th, 1920. (176,170.)
36,623. "Measuring instruments for incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). December 31st, 1920. (176,190.)
36,624. "Methods of protecting electric transmission or distribution systems." British Thomson-Houston Co., Ltd. (General Electric Co.). December 31st, 1920. (176,191.)

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373. "Electric knife-blade fuse." A. L. Eustice. March 7th, 1918. (156,497.)
1,124. "Insulators." Metallurgique Electrique (Ancienne Soc. Anon. des Etablissements Vedovelli et Tristley). December 13th, 1919. (157,247.)
1,237. "Arrangement for the suppression of the earth leakage current of high-voltage networks." Siemens Schuckertwerke Ges. May 31st, 1918. (Addition to 157,123.) (157,325.)
1,486. "Crystal detector for wireless telegraphy." A. Bonnefont. November 13th, 1919. (157,778.)
1,844. "Well-globe fittings for electric lamps." Veritys, Ltd., and T. I'Ons. January 12th, 1921. (176,201.)
1,845. "Wall fittings for electric lamps." Veritys, Ltd., and T. I'Ons. January 12th, 1921. (176,202.)
2,110. "High-frequency telegraphy and telephony over wires." Ges. fur Drahtlose Telegraphie. January 16th, 1920. (158,198.)
2,269. "Method and apparatus for carrying out electro-chemical gas reactions." Dr. H. Spiel. July 19th, 1917. (158,250.)
3,470. "Adapters for use in connection with electric lighting and other circuits." F. Young. January 28th, 1921. (176,230.)
3,665. "Brush-holders for dynamo-electric machines." E. H. H. Hassler. January 31st, 1921. (176,225.)
6,138. "Secondary electric batteries or accumulators." B. Heap and Chloride Electrical Storage Co., Ltd. February 23rd, 1921. (176,244.)
7,285. "High-tension electrical condensers." P. Bunet. May 18th, 1920. (163,684.)
7,749. "Insulating supports or holders for overhead electric trolley wires." E. R. Myers. March 11th, 1921. (176,253.)
8,448. "Electric heating apparatus." E. Muntwyler. March 18th, 1921. (176,259.)